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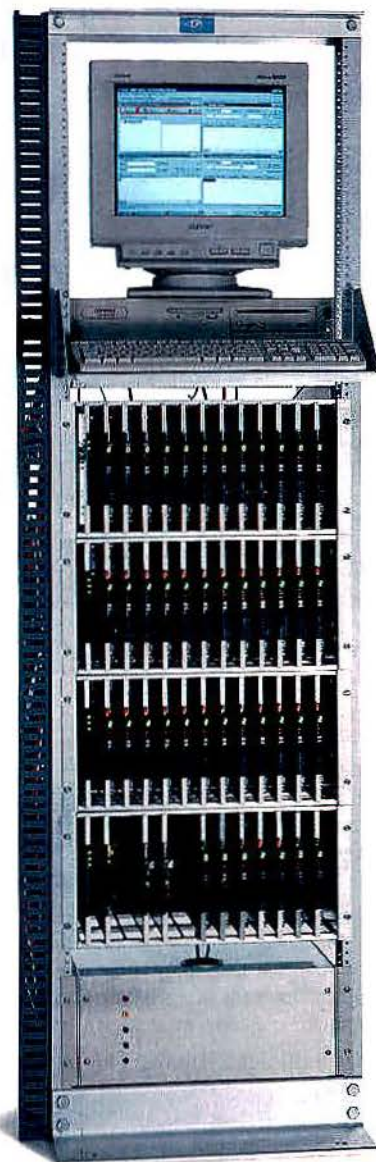
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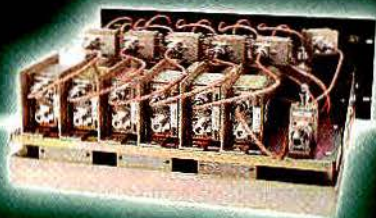
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IWCE 'buzz' and equipment demonstrations

Manufacturer 'buzz'

An interesting aspect of IWCE was the talk involving Relm Wireless, Intek Global land mobile radio, Uniden Corporation of America's Private Radio Division, Hitachi Denshi, John Simmonds and others.

For example, two sources said that representatives of Hitachi had visited Relm to talk about manufacturing two-way radio products on Relm's behalf. Hitachi has been a long-time supplier to Intek, making almost all of its Midland FM two-way radio products. Although one source reported that Relm and Hitachi inked an agreement on March 30, a top official at Relm said flatly that Hitachi did not even visit his company—no discussions, no agreement. Oh?

Another two sources said that a group including Simmonds had approached Intek about buying its land mobile radio business. Word is that the owner of Midland Consumer Radio, which is entirely separate from Intek Global, was interested in buying the land mobile radio business several years ago and has made a renewed offer.

Additional sources said that at least the Simmonds group, if not others, is talking to Uniden about buying its Private Radio Division. Uniden makes at least one of the radios sold under the Midland brand, and originally (we're talking during the '70s) made all of the Midland two-way communications products.

Another group is reported to be trying to talk with Hitachi about selling its radios under the Hitachi brand.

Where these Hitachi agreements would leave Intek is uncertain. During the period when Simmonds owned what now is the Intek land mobile business, he apparently was preparing to acquire Hitachi's tooling to manufacture radios in Canada at a factory owned by the Simmonds Electronics division of Simmonds Capital Ltd. The move would have taken advantage of North American Free Trade Agreement (NAFTA) provisions. Instead, Simmonds sold a majority interest in Intek Global to Securicor, perhaps leaving Intek's relations with Hitachi somewhat strained to this day.

* * *

Equipment demos

DCMA — ComSpace conducted twin demonstrations of its digital carrier, multiple-access (DCMA) technology at its booth and in a van equipped for test drives. The booth demonstration showed how eight voice paths

could fit within a 25kHz bandwidth, the width of a current FM channel. One of the demonstration transceivers was down during my booth visit, yet the spectrum analyzer showed how the other three (plus the gap for the missing signal) fit the bandwidth. The capacity of the four signals that fit the bandwidth is doubled with time-domain duplexing, yielding eight voice paths.

The audio in the booth sounded good.

The audio in the van sounded less-than-



good. I wish I could say it sounded good. But I can't. The operator in the van even had his counterpart at the base station switch from playing a recording to reading live from a brochure, but the audio still sounded "watery." It reminded me of the first time I called the Nextel investor relations representative and he answered on a 6:1 time-division phone. Watery audio.

One rule-of-thumb says audio should be sampled at twice the rate as its highest frequency component. To capture harmonics in the 15kHz to 20kHz range, compact discs use sampling at 44kbps or higher. Voice communication is adequately conveyed with a 300Hz to 3kHz frequency response, so a 6kbps sampling rate probably is adequate.

The "watery audio" problem is what led Motorola to offer Nextel a 3:1 time-division option, which Nextel uses for telephone interconnect calls. Radio users get accustomed to a different audio quality than what telephone users expect. Nextel continues to use the 6:1 time-division option for dispatch. Another network operator with similar Motorola equipment, SouthernLinc, uses 6:1 on all calls. So audio quality is a matter of opinion and a matter of choice.

For example, another individual riding in

the van with me said she did not hear the watery audio sound. And this was an individual who worked many years for a radio manufacturer and as a dealer, someone highly familiar with voice communications equipment. So to be fair, I'm saying that although I was slightly critical of the audio, she was not.

LM portable — Intek Global had samples of its long-awaited portable 220MHz linear modulation (LM) transceivers. An Intek representative and I used them inside and outside of the convention center. Inside, the communication was interrupted either by poor propagation with the repeater or interference or a combination. Outside, with perhaps better propagation to the low-powered repeater in the Hilton, they worked better.

Here I am, being "Mr. Hi-Fi," again, and I'm saying that the audio sounded "different" from FM. Okay, it isn't FM; it's LM. I probably would get used to it and not think of the difference. After all, in the 1960s, I got used to the difference between AM and single-sideband (SSB) communications audio. Does communications audio have to be toll-quality (which means "telephone-quality") or CD-quality? No. (On radio commercials, I heard a Kansas City PCS carrier tout, falsely, the digital quality of their audio, saying, "digital, like CDs.")

Compared to wireless telephone handsets and many FM portables, the LM portable is big and heavy, reflecting the challenge of communicating with distant sites used by two-way radio compared to nearby sites used by cellular, PCS and ESMR systems. At 220MHz, it takes more portable transmitter power, which requires a larger power amplifier and battery.

The Intek representative said the unit probably is going to be expensive, too. Yet with the business radio application emphasized by Intek, 220MHz portables probably won't be as widely used as mobiles. If the sale of 20 mobiles turns on having one portable included for the use of a supervisor or manager, then the availability of an Intek portable will make a difference. At least, that's the way it was explained to me. The portable, by the way, isn't available quite yet, though. Soon, he said. Soon.

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FEATURES AND NEWS: Microphones; microwave links.

PLUS: Robert H. Schwaninger Jr.'s "In the Public Interest"; Don Bishop's editorial; product focus: batteries.

AND IN THE MONTHS TO COME: Computer-aided dispatch; fire radio and data; railroad communications; the changing face of paging; system upgrades; location technologies; test equipment.



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calendar

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1-3—Canadian Wireless, sponsored by the Canadian Wireless Telecommunications Association, Vancouver, Canada. Contact: 613-233-4888, ext. 102.

6-10—Supercomm, sponsored by the TIA and USTA, Georgia World Congress Center, Atlanta. Contact: 800-278-7372.

27-July 1—UTC Telecom '99, sponsored by UTC, Nashville, TN. Contact: 202-872-0030.

28-29—Leadership Conference & Annual Meeting, sponsored by AMTA, ANA Hotel, Washington, DC. Contact: 202-337-7773.

July

14-16—Communications Expo/Show of the Americas, Miami Beach Convention Center, Miami. Contact: Jackie Gonzales, 305-412-9000.

26-28—Telecommunications Resellers Association Summer Carrier Forum, Westin Harbor Castle, Toronto, Ontario Canada. Contact: 202-835-9898.

August

8-12—Association of Public-Safety Communications Officials—International (APCO) National Conference, Minneapolis. Contact: 904-322-2500.

September

19-22—Fall Vehicular Technology Conference, sponsored by IEEE Vehicular Technology Society, Amsterdam, The Netherlands. Contact: 904-322-2500.

23-25—Personal Communication Showcase, sponsored by Personal Communications Industry Association, New Orleans. Contact: 703-739-0300.

October

2-4—Wireless I.T. '99, sponsored by the Cellular Telecommunications Industry Association, Santa Clara, CA. Contact: 202-785-2842.

18-21—Annual APCO Canada Conference, sponsored by APCO, New Brunswick Canada. Contact: Jim Flanagan 888-CANAPCO.

27-30—Industrial Telecommunication Association/USMSS joint Conference, sponsored by ITA and USMSS, Grand Hyatt, Washington, DC. Contact: 703-528-5115.

November

2-4—Wireless I.T., sponsored by the Cellular Telecommunications Industry Association, Santa Clara Convention Center, Silicon Valley, CA. Contact: 202-785-2842.

10-14—Communications Marketing Conference, sponsored by the Communications Marketing Association, Harvey Hotel, Dallas. Contact: Jack Armstrong, 410-628-9300.

15-16—AMTEX, sponsored by the American Mobile Telecommunications Association, Hilton, Walt Disney World Village, Lake Buena Vista, FL. Contact: 202-331-7773.

15-16—Fourth International Congress on Commercial Trunked Radio, sponsored by the

International Mobile Telecommunications Association, Hilton, Walt Disney World Village, Lake Buena Vista, FL. Contact: 202-331-7773.

17-19—TelecomLatina, co-sponsored by *Mobile Radio Technology*, Miami Beach Convention Center, Miami. Contact: 800-288-8606.

19—Radio Club of America Communications Symposium, 91st Anniversary Dinner and Awards Presentation, New York Athletic Club, New York. Contact: Gerri Hopkins, 732-842-5070.

2000

February

28-March 1—Wireless 2000, sponsored by the Cellular Telecommunications Industry Association, Ernest Morial Convention Center, New Orleans. Contact: 202-785-0081.

March

19-22—ENTELEC 2000, sponsored by ENTELEC, Dallas Convention Center, Dallas. Contact: 281-357-8700.

22-24—International Wireless Communications Expo, co-sponsored by *Mobile Radio Technology*, Las Vegas Convention Center, Las Vegas. Contact: 800-288-8606.

May

May 8-11, Telecommunications Resellers Association Spring Conference and Exposition, Philadelphia Marriott. Contact: 202-835-9898.

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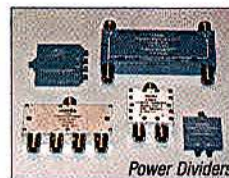
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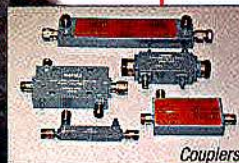
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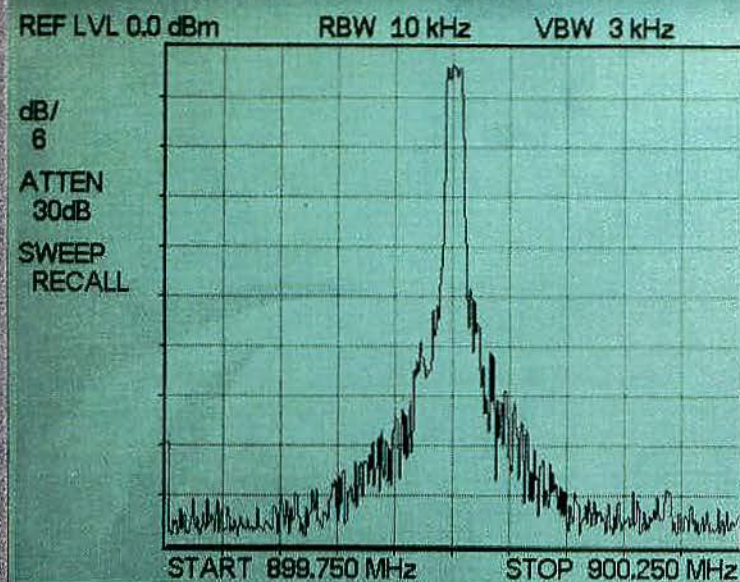


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MS2711



OPTIONS

CLOCK

SELF
TEST

STATUS



1



2

ESCAPE
CLEAR

START
CAL

3

AUTO
SCALE

4



SAVE
SETUP

5

RECALL
SETUP

6



LIMIT

7

MARKER

8

ENTER

SAVE
DISPLAY

9

RECALL
DISPLAY

0

RUN
HOLD
+/-

ON
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PRINT

SYS

MODE

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AMPLITUDE

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Lighting the way

Last November, a helicopter ambulance nearly hit a radio antenna in Texas that was not marked with aviation obstruction lights. The near-nightmare happened in Muleshoe where the helicopter, on an emergency call, was forced to "alter its approach pattern" when the pilot unexpectedly encountered a dark tower at night.

Then it happened again, a month later. A helicopter ambulance, once again responding to an emergency at night had to alter its approach when the pilot suddenly saw a dark 500-foot antenna structure. The structure, near Arcadia, FL, was under construction and had

no temporary obstruction lights. The FCC responded to both incidents with strong warnings to owners of antenna structures.

Luckily, no one was injured in these two incidents, but my mother's words echoed in my ear, "They could have been hurt!"

This is one FCC rule that serves a clear purpose: Marking your antennas with proper lighting keeps planes, Underdog and other flying objects from running into your antennas. Lights can protect not only your tower, but also the person who could collide with the tower. FCC rules require that antenna structures more than 200 feet high, or in certain areas designated by the FAA, must be marked with lights from dusk to dawn. If a top tower light is out for more than 30 minutes, the FAA must be notified so that a Notice to Airmen can be issued. Lighting is important during construction, too. A light should be installed at the top of the structure, along with temporary lights placed where the permanent lights would be required. Also, if a tower has an antenna or structure more than 20 feet above the main tower, it must be lit with a flashing light. These rules are in the Code of Federal Regulations (CFR), Title 47, Part 17.

The FCC adopted a no-tolerance policy after the incidents, on Jan. 13, 1999, stating that "All existing, unregistered antenna structures that require registration ... must be registered immediately, or their owners may face possible monetary forfeitures or other enforcement action."

The FCC also addressed antenna structure lighting in a Y2K Forum on Dec. 7, 1998. The purpose was to warn antenna owners about Y2K-related problems that could cause a life-threatening light system failure, and to inform the parties of the FCC's expectation that they evaluate their systems and be ready to promptly report and correct any light outages or malfunctions. The Compliance & Information Bureau found that 28% of towers it had audited last year were not registered as required by FCC rules. The FCC plans to continue its audit this year, so look out.

Lighting antenna structures is critical, and promptly reporting outages is just as important. Companies who offer lighting systems and light monitoring services include Engineered Endeavors; Flash Technology of America; Honeywell, Hughey & Phillips; Trylon-TSF and Valmont/Microreflect. Most tower companies will inform you of the importance of lighting when you erect a tower, but it is important to keep the lights maintained and to register the structures with the FCC. Aircraft pilots depend on lighted antenna structures for navigation, and to avoid collisions.

—Nikki Chandler

nikki_chandler@intertec.com

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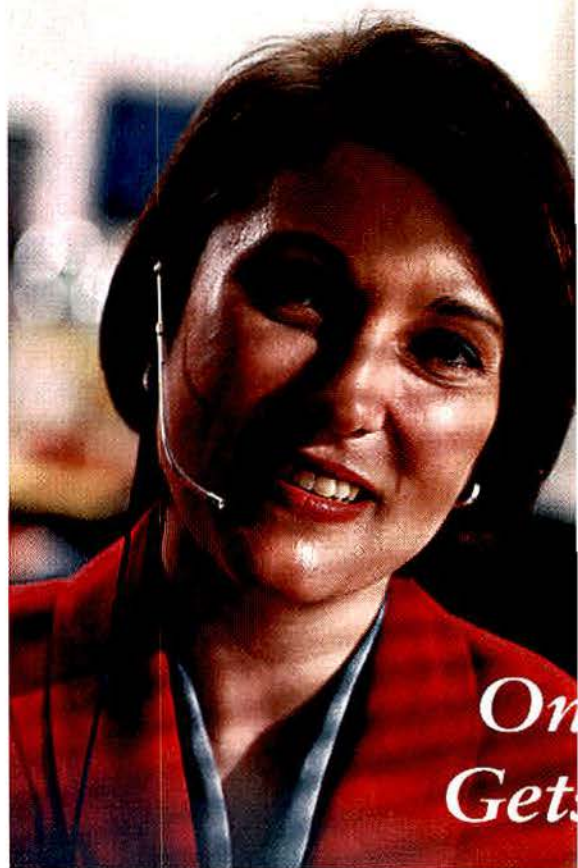
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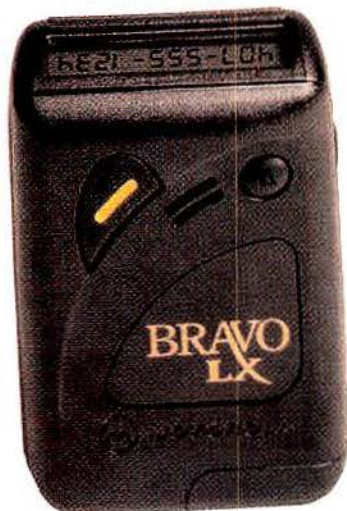
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Not all CMRSs cause interference

I read Joe Kuran's article regarding interference experienced by WCCA (March) with great interest. As SMR/Private User counsel to PCIA, we have been aware of adjacent channel interference problems with regard to IDEN technology for a while and have helped local licensees to resolve problems when they arise.

However, the article is somewhat misleading in that its lead paragraph and other areas imply that *all* commercial mobile radio services (CMRS) pose this danger of adjacent

channel interference. In fact, it is not a function of the manner in which the system is licensed (CMRS or PMRS, carrier or non-carrier), but rather a function of the type of technology being employed.

Hundreds of analog carrier and non-carrier systems operate on adjacent channels very nicely. The introduction of digital technology, as well as the use of multiple low power and/or simulcast sites (all of which occur in this case) bring new challenges that we as an industry must work together to resolve.

In addition, the "box" placed alongside the article regarding UTC's complaint regarding "interference" does not concern adjacent channel interference, but rather co-channel sharing of non-exclusive channels. This is a different issue entirely and one with which PCIA disagrees with UTC's analysis. This is a function of the frequency coordination system as a result of the new "refarming" rules, and the coordination issues are being addressed by the Land Mobile Communications Council Refarming Task Force, chaired by PCIA.

We are working hard on these interference issues, and we encourage everyone to put forth their suggestions for an industry-cooperative solution.

—Alan Tilles

Shulman, Rogers, Gandal, Pordy & Ecker

Other interference experiences

Joe Kuran's story in the March 1999 issue really struck home! I do radio-coverage mapping and drive testing in the Los Angeles area. In the past four years, I have experienced *two* situations exactly like his.

In the first, 900MHz utility company radios were rendered unusable by receiver desense and overload over large areas of Los Angeles (L.A.) and Orange counties. It was caused by extremely high power multisite 900MHz paging systems with numerous kilowatt-plus ERP transmitters low to the ground on building roofs (rather than on distant mountaintops). I drove hundreds of miles around L.A. and Orange counties observing carrier levels that never dropped below -50dbm and frequently peaked up to -30 or -25. (I was forced to use a 20dB pad in front of an IFR-1500 to read the levels at times.) In the second, I have observed the reliability of 460MHz L.A. county paramedic communications steadily deteriorating. In this area, the EMS channels are used solely "direct" base-to-mobile (no repeaters), with the "mobile" typically a low-power hand-held or telemetry packset ("biocomm") radio sitting on the ground. In either case, the radios don't have much receiver front-end selectivity or dynamic range. They are increasingly being blocked or desensitized by numerous signals of -55dBm or better just outside the paramedic band. In the L.A. area, high-power paging transmitters at low-to-the-ground sites are proliferating less than 2kHz outside the band of 10 paramedic channels as paging operators attempt to increase in-building penetration of their systems. They seem to be locked into a competitive arms race of ever-increasing ERP. In the battle between the paramedic typical 1W-5W ERP and the paging systems multikilowatt ERP, the medics are losing.

—Stephen H. Smith

Telecom Systems Engineer

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The goddess CALEA

By Robert H. Schwaninger Jr.

"And it came to pass that the centurions of the Federal Bureau of Investigation and the United States Department of Justice looked across the sea of change in telecommunications and declared 'WE CAN'T HEAR YOU!' And, yea, they prayed to the gods and asked for help to defeat the barbarians who would employ telecommunications for evil. And the gods sent them CALEA."

Okay, it didn't happen exactly that way. What really happened was that the FBI noticed that it was having trouble doing wire taps. It seemed that the G-men were falling behind because of digital technology in wireless and wired communications; new interconnections/information retrieval systems, like SS7; the introduction of competitive local exchange carriage; and a host of other really technical stuff.

The FBI also noted that although carriers evinced some level of cooperation in the feds' wiretapping effort to gather dirt on do-badders, the cooperation required to effectively keep up in the battle against crime was just not there. So, the FBI asked Congress, via the Executive Branch, to pass a law to "clarify" carriers' responsibilities to make facilities available for wiretaps.

The idea was simple. The FBI needed Congress to tell the carriers that the FBI didn't have to say "pretty please" every time it wanted to perform a wiretap. Congress agreed that the ends of justice required this cooperation, so it passed the Commu-

nications Assistance for Law Enforcement Act (CALEA) about a year ago. In essence, CALEA states that common carriers will make available the means by which the feds can engage in wiretapping activity, employing the carriers' terminal or switch capacity for the purpose of authorized interception of

to get the cops to accept certain standard equipment for installation by carriers to meet the requirements of CALEA. The issue of customer privacy will be an ongoing problem.

Under the Communications Act, and in accordance with many local laws, customers are entitled to privacy in the making and receiving of electronic communications. Interception of, and/or publication of the content of communications is prohibited. Fines, imprisonment and guest spots on talk shows can be imposed on people that repeat communications made or received from celebrities or elected officials or private citizens.

The obligation to keep customer communications private falls on carriers, which must ensure that all interceptions are "authorized." Authorized interceptions are those that proceed from a valid warrant, court order or other legal mechanism that entitles a law enforcement agency to perform wiretaps or employ pen registers or trap-and-trace devices.

The tenets of CALEA are incorporated within Section 229 of the Communications Act, and the FCC has recently adopted rules for all common carriers' future compliance with CALEA obligations. On March 15, the FCC adopted new Part 64 rules (Miscellaneous Rules Relating to Common Carriers), sections 64.2100-64.2106, which require common carriers to file

what amounts to an employee manual. The filing demonstrates that the common carrier has adopted internal policies and procedures for dealing with unauthorized and authorized interceptions of customer communications.

In balancing the interests of carriers and law enforcement agencies, the FCC decided that the goddess CALEA is not all-powerful. The FCC did not mandate many changes in carriers' systems, nor did it provide any obligation that specific equipment would be provided by carriers for compliance with statute. What the FCC did require, however, was that



Illustration by John Hayes

customer communications.

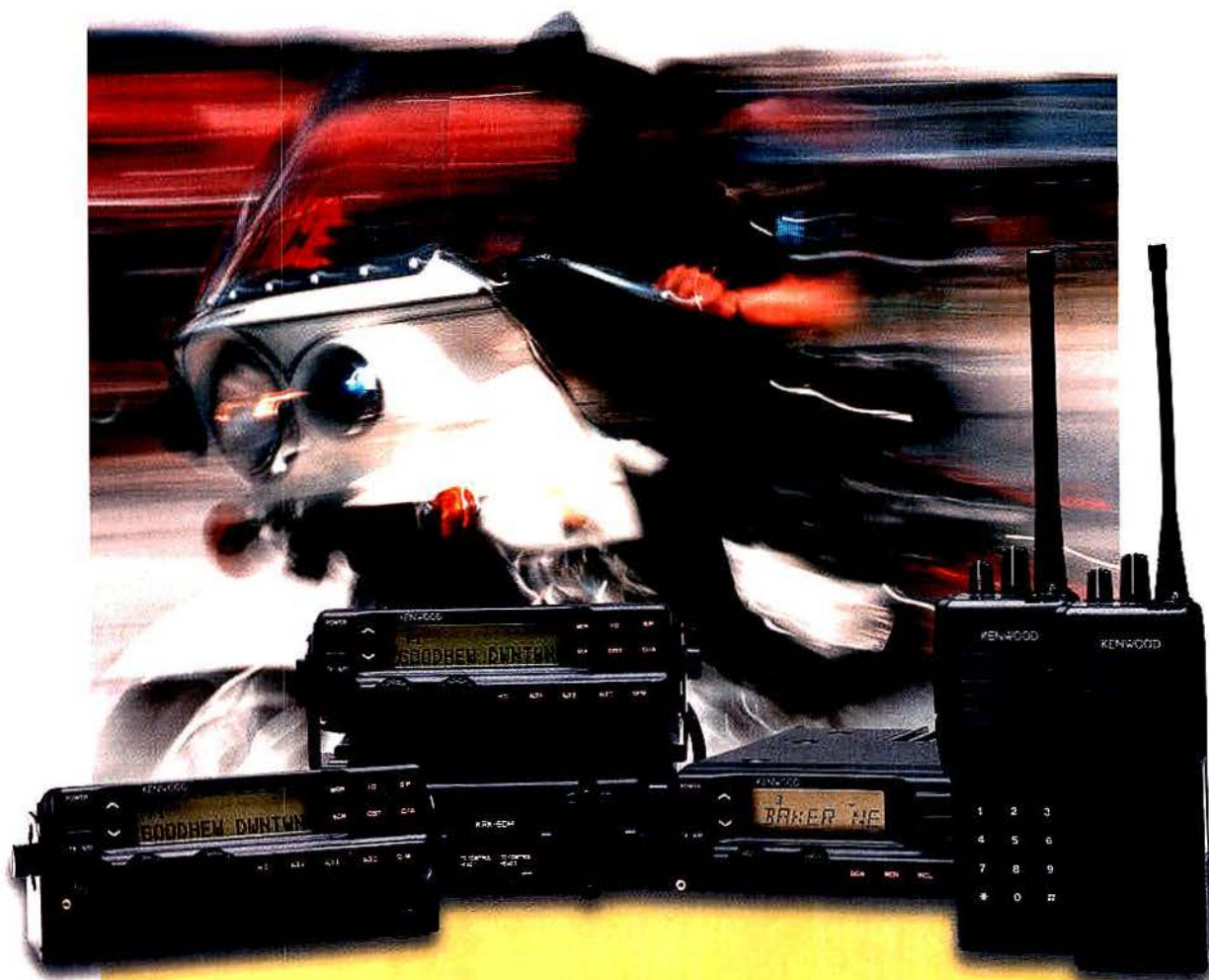
Competing interest

While law enforcement has its agenda in ensuring its ability to listen to the nefarious goings-on of crooks, smugglers and former Speakers of the House, carriers have competing interests—the cost of cooperation and the need to ensure that their customers receive all expected privacy in the content of communications.

Carrier organizations like CTIA and PCIA continue to debate the issue of cost as they try

Schwaninger, MRT's regulatory consultant, is the principal in the law firm of Schwaninger & Associates, Washington. He is general counsel to Small Business in Telecommunications and a member of the Radio Club of America.

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each carrier provide a comprehensive plan, subject to FCC review and approval, that demonstrated that the carrier had created the necessary internal capacity to respond promptly to requests by law enforcement agencies.

What you should do

Meeting the new CALEA guidelines is something that looks far simpler than it is. By the time one designs a manual that demonstrates compliance with each of the general guidelines set out in the new FCC rules and policies, the Communications Act and the practical environment of the marketplace, the document could become quite complex. I

therefore suggest that common carriers get professional help from a scaly creature known as a "lawyer."

The manual should include:

1. The name of a senior officer or employee who will serve as a contact for law enforcement agencies.
2. A job description of the contact person, including a way for the police to contact that person.
3. The manner in which an interception can be performed promptly.
4. A definition of standards for determining whether the requested interception includes "appropriate authorization."

5. A statement of policies for employees in determining whether an interception is lawful and will be allowed by the carrier.

6. A method of informing a contact officer regarding lawful interceptions in accordance with federal or state statutes.

7. The creation of a method of reporting unlawful or unauthorized interception.

8. The manner of maintenance of records in accordance with guidelines.

See how *simple* this is?

The reporting requirement for demonstrating compliance with CALEA is not simple, despite the FCC's rare best efforts in attempting to reduce the burden for carriers. What is burdensome is creating the manual prior to the 90 day deadline following publication of the Report and Order that was released on March 15.

So, what you should do is contact a lawyer to assist you in putting together the filing before July 1. If you don't—consider this: It would take only one computer run of all Commercial Mobile Radio Service (CMRS) licensees compared to all filers of a CALEA manual to determine who did or did not comply with the new rules. Then, it only takes one more computer file merge function to send forfeiture letters to all non-filers. The wrath of the goddess CALEA would then befall all CMRS fish in a barrel.

Some final thoughts

The design of the CALEA manual should allow it to be easily updated. Although you will have to suffer the initial burden of having to assemble and file this monster, you should not have to reinvent the wheel every time your company makes a small change. So, in designing the CALEA manual, have it organized so one small change won't require refileing a completely updated manual with the FCC.

If you are a small carrier and the FBI or local law enforcement guys come a-knockin', you may wish to direct them to the LEC switch for intercepting customer communications from your system. Although you will probably still need to record this activity, the law enforcement agents will probably have an easier time installing interception devices at the LEC's switching equipment than in your shop.

Finally, you may resent having to go through this exercise, and you may wish to rail against this assault on the Paperwork Reduction Act, but there will be little you can do to avoid performing this task. So, just think of me as Hermes, the messenger of the gods, and remember—don't kill the messenger. ■

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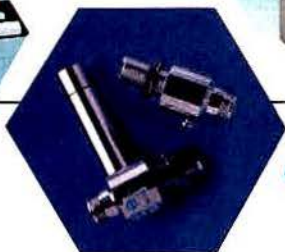
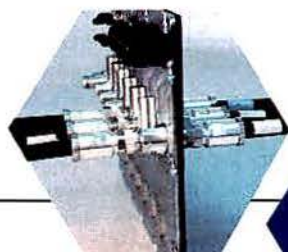
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GROUND ZERO

Lightning protection for a telecommunications site must include thorough geotechnical knowledge of that site. MRT interviews one of the leading experts in designing and installing grounding systems.

By D. A. Keckler

Lightning and the millions of dollars of annual damage it causes to telecommunications facilities creates a highly visible mental image—there's a big flash, followed by a loud noise and visible charring of unprotected equipment. One of the first steps in effective lightning protection, however, deals with the *invisible*—the geotechnical conditions below ground level at the site.

The same soil reports that are necessary for competent tower construction are equally applicable to competent grounding of the tower and the equipment that uses it. Required procedures include boring to appropriate depths, performing soil and rock analysis to establish resistivity, identifying water tables and climatic conditions and other factors. Just as the absence of this information can void a tower manufacturer's warranty, lack of pre-planning related to grounding can also void the warranty on the communications equipment.

Betty Robertson, E.E., president of Torrance, CA-based Lyncole XIT Grounding, has been designing and installing grounding systems for nearly two decades. Before starting her own company in 1985, Robertson worked as an engineer at Continental Telephone, which she credits as one of the leaders in developing site protection and grounding protection for telephony equipment and contributing to the creation of industry standards. After her work with Continental, Robertson joined Hughes Aircraft at its Torrance facility. Hughes was using XIT as its standard grounding system. The XIT system incorporates exothermic welding to avoid an increase in resistance over time that can occur with compression fittings that may corrode or loosen. (See photo on page 26.) The rod's metallurgy is also designed to generate moisture to maintain contact.

Keckler is features editor. His email is david_keckler@intertec.com.

"I said, 'Wow! It answers every engineering question I ever had about grounding,'" Robertson said. "It makes its own moisture, it doesn't need maintenance, it's all-copper, and there's no dissimilar metals." When the XIT patent became available for sale, Robertson seized the opportunity and, supported by her degrees in engineering and business, formed Lyncole. The company now employs about 35 people, including 10 full-time engineers, and has been designing and installing systems for sites ranging from small government and service provider operations to those of Fortune 500 telecom companies. The company functions both as an engineering consultant and as a manufacturer of electrolytic grounding systems. Robertson noted that the engineering staff still outnumber the sales force, "So you can see where my heart is," she said.

Soil descriptions

Robertson concurred that geotechnical surveys are crucial to developing an effective grounding system. "Generally, gravel or loosely packed soil is much higher in resistance and, particularly in the telecommunications market, companies like Lucent, Nortel and Motorola will tell their buyers 'If you don't have a 5Ω or less ground, we're not going to warranty our equipment, and if you ask for a variance or a waiver on that, then we may go to 10Ω, or we may not insure it to the same level of replacement.'"

"It's becoming extremely important to know and anticipate, or predict, what your ground is going to be," Robertson said.

"The 5Ω or less can be predicted with calculations very closely. Our group, with good soil resistivity readings, can do that within about 2%. So we can tell you whether your installed system is going to be at 4.5Ω or 4.7Ω. So we've gotten pretty accurate at that over the last 15 years," Robertson said. "It's just now becoming

extremely important to the carriers because all of a sudden the equipment manufacturers are recognizing that 'When my ground resistance goes up, my equipment operates in a stressed mode, my equipment is noisier, it fails earlier and if there's a lightning strike and the lightning gets into the equipment, it's destroyed.' So each level of problem gets higher with the incident.

"But the incident only gets into the equipment if the ground resistance is above 5Ω" Robertson said. "By looking at soil resistivity and the geotechnical reports, or the soil characteristics, you can calculate very closely the results of putting in one ground rod, or electrode, or 10. Sometimes it takes that many, depending on what the spacing should be. That's where our consulting comes in. We do designs and tell them how many rods it will take, what spacing and how deep."

Lyncole performs calculations assisted by computer programs that have been customized to reflect its grounding equipment standards and experience. "All of the standard grounding systems would assume a 3/4" steel and copper-coated rod," Robertson said. "For our system we have 30 years of test data. Because I bought the patent from the inventors, we have all of their research they had done to qualify the rods and get them through UL listing. I feel pretty lucky at having all of that history to draw on, and I can use it to literally save the client money.

"Say we recommend four rods, and you'll get to 5Ω; very seldom could you get to 5Ω with three rods. The spacing is extremely important, and the depth, but you need soil resistivity and what I call a soil profile. It's like a doctor's exam: You need to know everything you can know about the soil and what you're going to get when you auger that hole into the ground 10 feet, and 20 feet, and 40 feet down," she said.

Robertson noted that compaction is generally better as depth increases, and better

grounding



compaction allows current to dissipate more effectively, but moisture is also important.

"It [current] has to have a medium to travel through that soil," she said.

Unsatisfactory geotechnical reports should evoke the same business decision for grounding concerns that they do for inability to support a tower, Robertson said. If the report is not good—move the site. "Generally, if you can't get the foundation support because of the soil, you probably can't get a good ground. You may be able to drive pilings so your equipment doesn't slide down the hill, but you're not going to be able to get a very good ground because you need that compaction. It can't be loose rock or a

mudslide area that is going to destroy a grounding system or prevent a grounding system from working at its 5 Ω -design criteria," she said.

Robertson also noted that soil resistivity measurements should be taken in at least three different directions at several spacings on even small sites. More probe

data allows designers to provide the most effective design and compensate for variations of soil resistivity that may vary from clay to adjacent limestone.

down. So it's the first few feet of your grounding system that works during lightning, or is most effective. There are many places in many countries that use five-foot ground rods because they feel that lightning is the only thing they need to protect from. ... In the United States, eight feet is the minimum, according to the national electrical code. Generally we, engineers in general, have zeroed in on 10 feet because we have added in a safety factor. It's about five feet below where there would be disturbed earth.

"In many cases we go to 20 feet deep because the soil is more conductive. You get a little closer to the water table so there's a little more moisture.

There's more conductivity,

and when you have to auger a hole to put the rod in place, you're only setting up that drill machine up once to go down 20 feet, rather than going down 10 feet and using three 10-foot rods to do the same thing that one 20-foot rod would do," she said.

Robertson said Lyncole prefers to do soil testing to a depth of 60 feet.



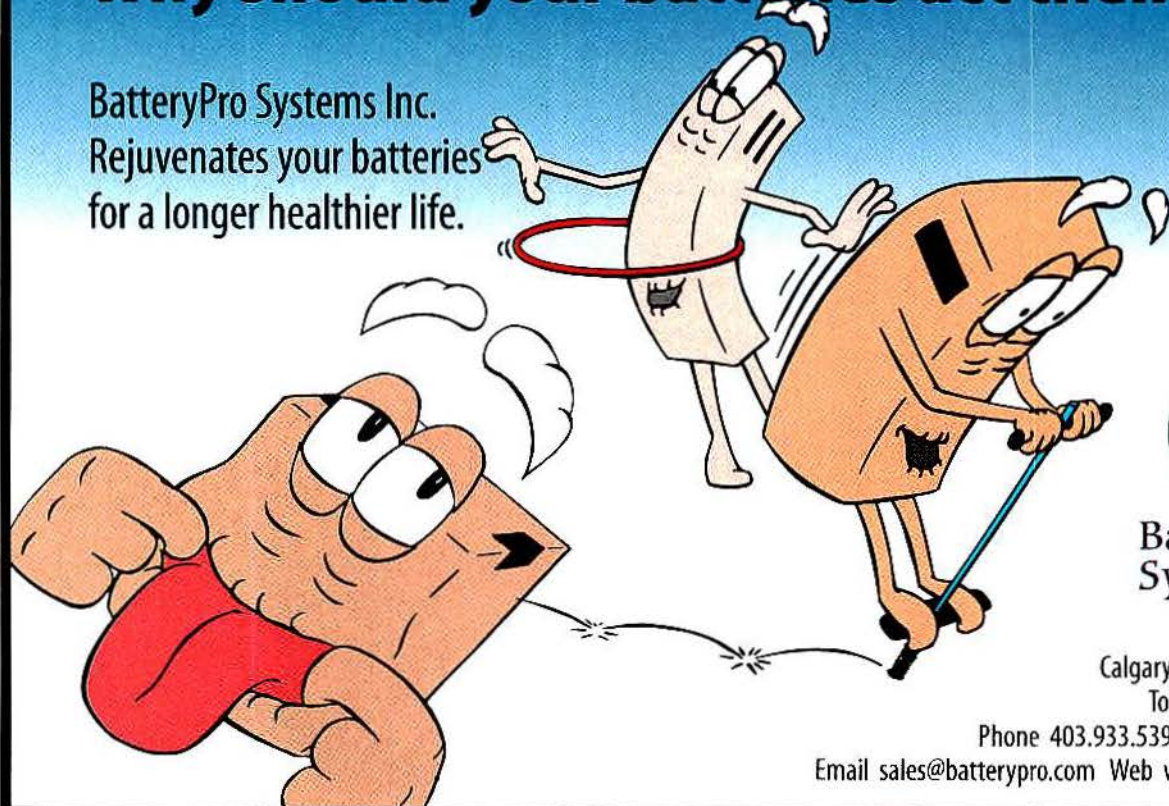
Installation of a grounding system for a telecom facility.

Safety factors

In conjunction with the soil profile, the nature of lightning strikes where the site is to be located affects the design of an effective grounding system, Robertson said. "Basically, the frequencies of lightning are generally dissipated or reflected at somewhere between 18 and 24 inches

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"Generally, we like to do soil resistances at five, 10, 20, 30, 40, 50 and 60 feet deep. When a geotechnical firm does the soil resistance, we get the cores of dirt they dig out as deep as they will go. That's what allows us to perform our best for the customer."

Fill materials

A standard part of Lyncole's grounding systems includes fill material to surround the grounding rods, Robertson said. The company uses a proprietary modified version of bentonite clay (driller's mud) as backfill material for the systems.

"In driller's mud, there are polymers

added to that to prevent water from seeping through it, but we want that backfill material to absorb the water as it would do naturally and also release it. As our rod produces moisture, we want the backfill to absorb that moisture and replace it if the area has become dry due to drought.

"Unlike driven rods, we can put the active XIT system in underneath a building—and it can be an old building, 20 or 30 years old. So we core through the concrete, and of course it's very dry under there. So by putting the clay, in a slurry form, under there, it fills in all the cracks and crevices that either the rock or auger have left, so you get

excellent rod-to-earth contact. It never fully dries out, and with the XIT system replenishing that moisture on a regular basis, you always have that a current-carrying solution to earth," Robertson said.

Grounding design

When planning rod spacing, Robertson noted that one grounding system should be located as close to the equipment as possible—for instance, at the entry of tower cables into the service structure.

"You want to have one rod directly under where they make that 90° turn," she said. "The ground bus bar should be directly connected to earth. You want to have a straight path for that lightning surge to go to ground, rather than following some of that low-resistance cable into the building or into the equipment."

"The spacing between what you want to protect and the ground system should be as close as practical. The spacing between rods, to take the most advantage of the length of the rod, should be twice the length of the rod," Robertson said. The total available area of the site should be evaluated to maximize the spacing to achieve proper resistance. (See photo on page 24.)

Evaluation

The initial ground system test should be done before the system is connected to utility power, Robertson advised. "You have to have a benchmark." There is one meter that will test the ground system after it's energized, she said, but reliable readings are best obtained ahead of time.

Robertson noted a case where a single, 10-foot driven rod tested out at 65Ω with the neutral bond disconnected. With the utility neutral connected, the resistance dropped to 2.5Ω. ■

A corroded, defective ground rod.



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It's a portable life, but things can get better

Battery charging technology that can increase two-way radio performance can do the same for other battery-dependent tools and systems, reducing maintenance and failures at critical moments.

By Bryan Jackson, Graydon Hansen and Jody Steinberg

Ask technicians responsible for maintaining communications equipment about priorities, and they will tell you that reliability is number one. Ask them about issues of reliability, and they will tell you that battery problems can plague communications equipment. As portability has shifted from novelty to necessity, improvements in the functionality of portable products and wireless communications have changed the way we work and live. Even the best-designed products, however, have an Achilles' Heel that has yet to be addressed: a growing appetite for power that isn't well fed. Many batteries do not deliver the consistent reliability and performance that

products require. They lose capacity, deteriorate and allow communications and support tools to fail, often at the most critical moments. Sometimes, batteries fail the most critical tools of all: the backbone support systems designed to keep life-saving operations and communications equipment running without interruption.

Battery dependability

Rechargeable batteries have improved over the last 10 years as product designers have upgraded chemistries from sealed-lead acid (SLA or PbA) to nickel cadmium (NiCd) to nickel-metal hydride (NiMH) to lithium-ion (Li-ion). These advances have increased available power while providing smaller batteries optimized for more miniaturized, portable equipment. Despite chemistry improve-

ments, battery *dependability* remains a top concern of product designers and users—particularly emergency workers. Newer, better batteries cannot solve power problems when old charging routines are used. Without a charging system, *any* battery is useless. With a standard charging system, a battery powers the device, but lengthy charge times, capacity loss and poor product performance are the norm. The batteries that suffer most from standard charging systems are those oft-neglected batteries stored on low-tech chargers for emergencies. Required to deliver peak performance for short and sporadic periods, these seldom-used batteries often disappoint,

Jackson is intellectual property manager, Hansen is director, lead acid, and Steinberg is communications manager for Advanced Charger Technology, Norcross, GA.

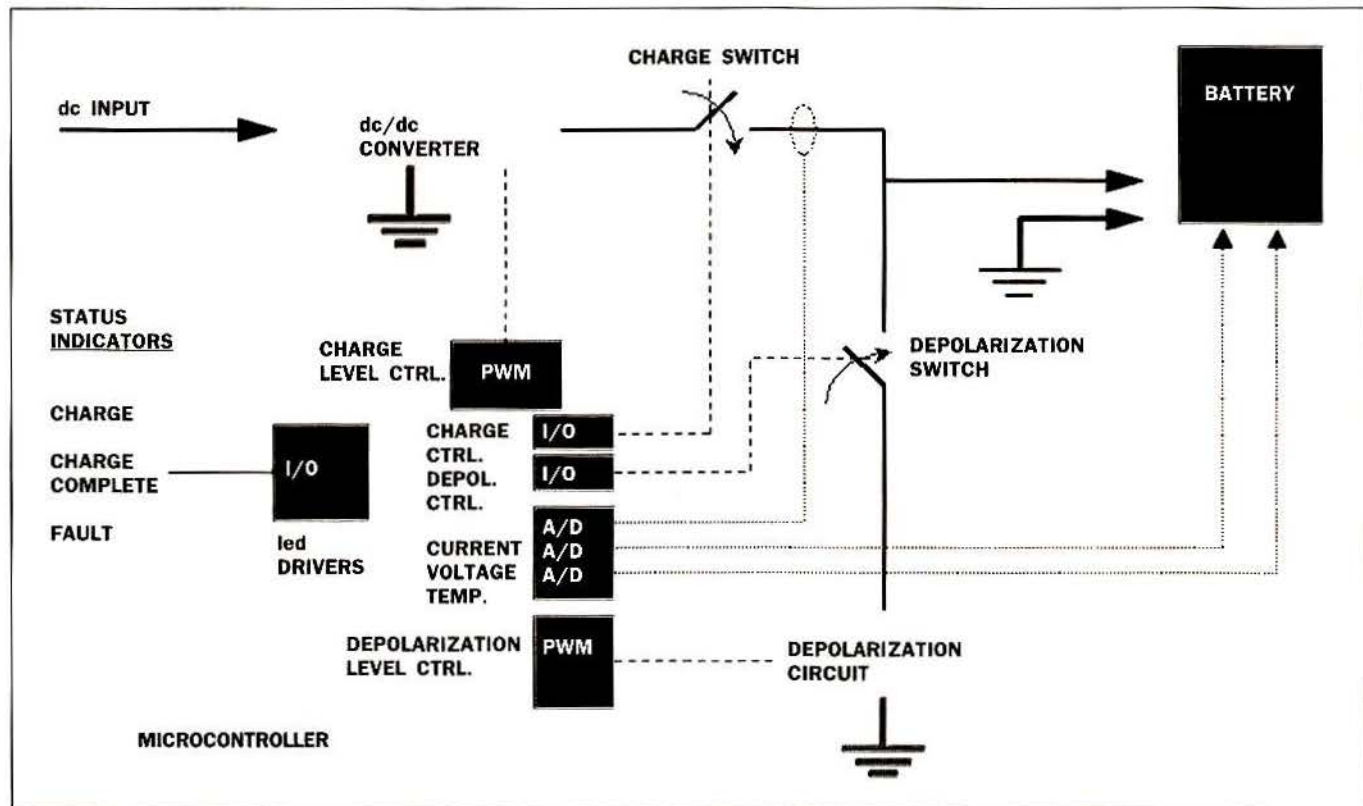
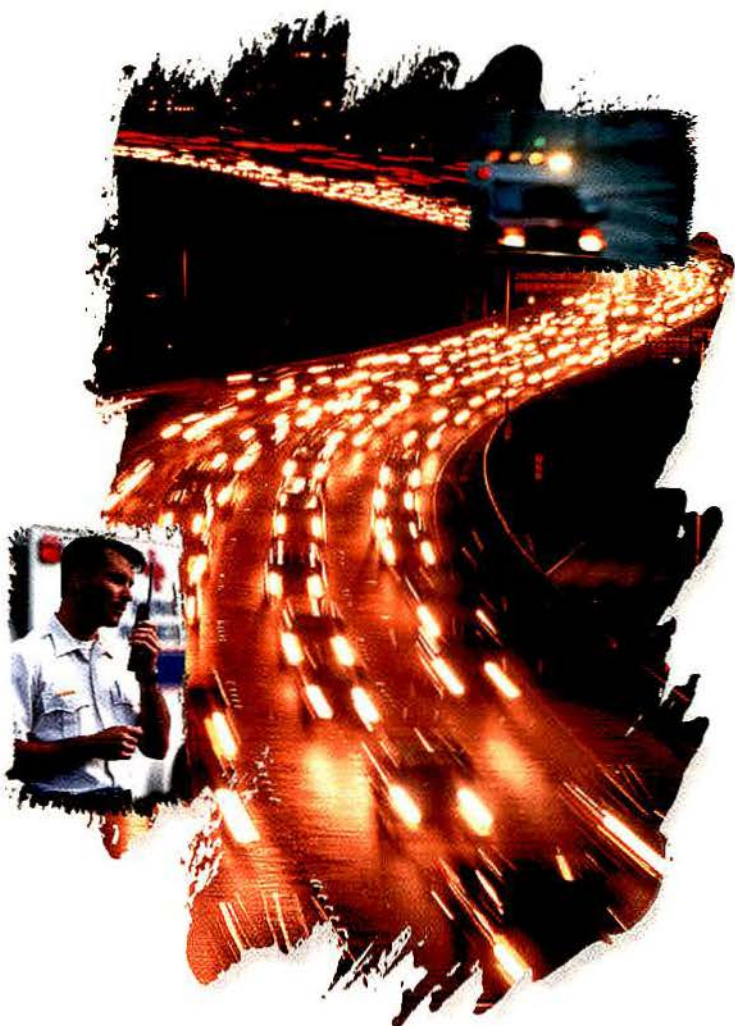
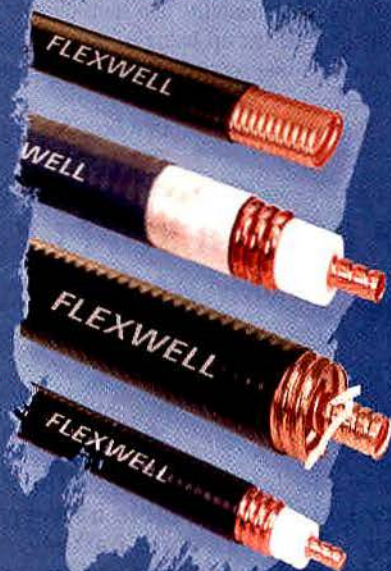


Figure 1. Enrev technology implementation circuitry.

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Photo 1. Charging station.

further exacerbating emergency situations. As long as batteries are a consumable product and business projections depend on their obsolescence, battery manufacturers have little motivation to improve chargers.

Common battery charging methods

The standard battery charger, or trickle charger, delivers a steady, low-level, 100mAh–200mAh, positive current. It does not stop charging when it reaches maximum capacity, so overcharging, heat generation, reduced charged capacity and a shorter battery life often result. In the case of NiCd and NiMH, if the battery isn't discharged prior to a trickle charge, voltage depression

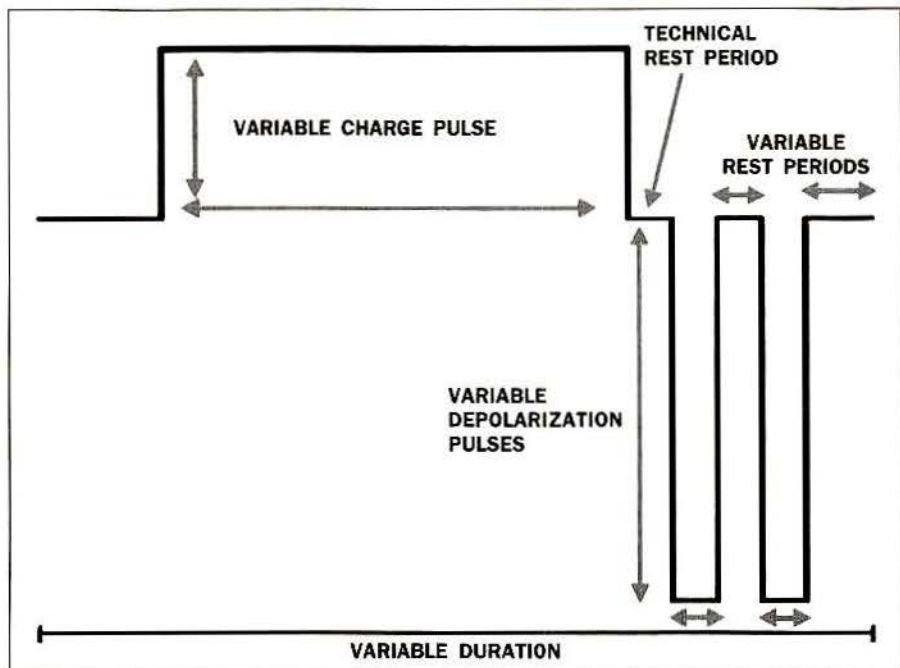


Figure 2. Sample Enrev waveform.

or "memory effect," which often causes the early demise of batteries, begins to occur even sooner. Most fast-charging systems use *constant current/constant voltage (CC/CV)* techniques that usually maintain the high current rate until it reaches a specified voltage, and then decreases current to hold that voltage. Over time, charging at a high constant cur-

rent will result in reduced capacity with each charge, rapid wear-down and fewer charge/discharge cycles for the battery. This deterioration of dependability can spell disaster for emergency back-up batteries left on charge and called into service after a long period of disuse.

Pulse charging, first introduced to charge

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PbA batteries in the early 1900s, helped extend battery life and speed up charge times, but it has not been the breakthrough that it was hyped to be. Many pulse chargers insert one positive and one negative current pulse of fixed size, to a certain level of capacity, and then "top off" with the trickle charge or the CC/CV routine. Most "advanced" pulse charging involves using a pre-programmed integrated-circuit chip to perform battery-charging functions. Companies that manufacture pulse chargers (often a companion for the battery-operated product they sell) will purchase an off-the-shelf chip to provide the "smarts," or charging technology of the prod-

uct. The manufacturer will then build a charger for a given battery-powered product using this pre-designed chip and some basic electronic components. The charging process usually consists of one or more fixed algorithms that combine a charge pulse with a discharge pulse and a rest period. Although these latter methods reduces the deterioration resulting from trickle charging and CC/CV methods, they still do not optimize battery performance.

Rethinking charger technology

ACT researchers developed a battery operating system that enables battery-powered

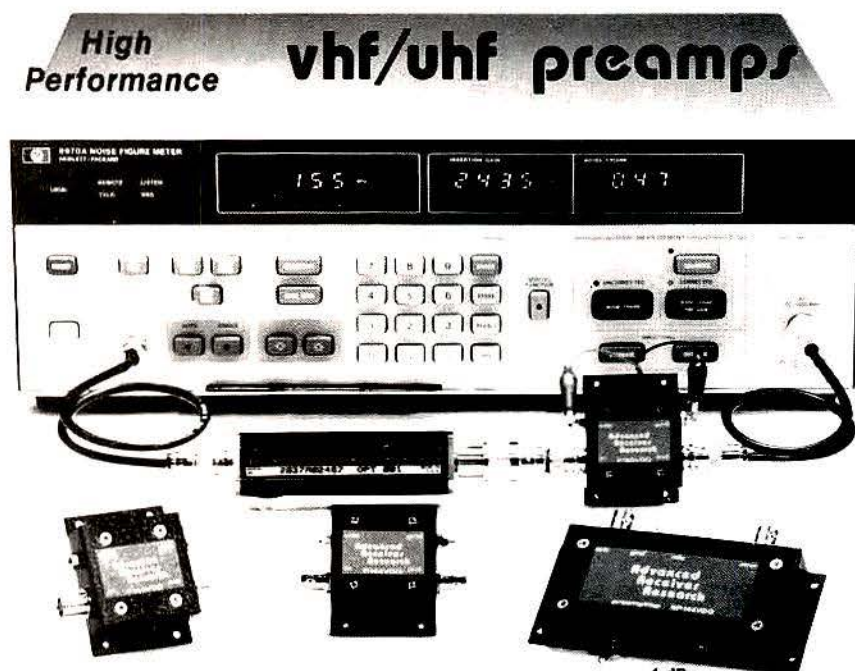
devices and/or chargers to deliver reliable, consistent power and performance for the life of the product. Research led to the development of patented Enrev technology, which yielded significant results with the four major rechargeable battery chemistries—Li-ion, NiMH, NiCd and PbA—and opened new possibilities for power-design engineers. Enrev technology reduces charging times from at least 30% to as much as 90%, which more than triples the life of the battery, does not increase battery heating while charging, delivers maximum capacity consistently and reduces formation time both in the manufacture and initializing of batteries. Most importantly, Enrev technology is intelligent and *interactive*. Self-adjusting software controls the charging and maintenance of batteries, eliminating the need for a labor-intensive maintenance program, and it varies in delivery to optimize any battery, at any stage in capacity or life cycle. This is especially useful for self-charging uninterruptible power supply (UPS) systems and other remote or hard-to-access battery power and back-up systems.

Inside Enrev technology

Applying charging algorithms and forming efficiency have significantly redefined some previously established limitations to battery charging. More than a decade of dedicated research and numerous patents have developed into the Enrev battery operating system, which is embedded as software onto a micro-controller.

Yuri Podrazhansky, a Russian immigrant with a background in electrical and radio frequency engineering, was busy searching for a solution to the problems plaguing his rechargeable batteries at home. He tried a new approach, manipulating battery chemistry from the atomic perspective, and created a process that controls the ions, molecules and compounds in a battery. Podrazhansky, now chief technology officer of research and development at ACT, discovered that single, high-magnitude, negative current pulses, commonly used in most "advanced" charging systems, cause ion transportation problems in the reverse direction, as well as excessive discharge of the battery, which increases charge time.

Enrev software provides real-time control of the electrochemical reactions during the charge process. This real-time control, along with the ability to monitor the electrochemical reactions and obtain instantaneous feedback, is what allows Enrev technology to efficiently charge any battery while increasing its cycle life. Enrev software has a set of tuned algorithms for each type of battery chemistry. The algorithms create *varying current waveforms* that dynamically change shape, amplitude, direction and duration within milliseconds in response to feedback from the



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P450VDG, P460VDG	450-460, 460-470	<0.5	16	+12	GaAsFET	\$109.95
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SP30VDG, SP35VDG, SP40VDG, SP45VDG	30-35, 35-40, 40-45, 45-50	<0.55	26	+12	GaAsFET	\$139.95
SP150VD, SP160VD, SP170VD	150-160, 160-170, 170-180	<1.6	15	0	DGFET	\$ 74.95
SP150VDA, SP160VDA, SP170VDA	150-160, 160-170, 170-180	<1.2	15	0	DGFET	\$ 86.95
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Podrazhansky's research in fast charging techniques also resulted in the discovery that the common methods of termination lacked the level of sophistication necessary to prevent battery degradation. For instance, he found that methods that relied on the sensing of battery voltage and its negative change did not provide a reliable indicator of the completion of a charging cycle. Temperature-sensing methods fail because the warning comes too late to prevent the battery from overheating. The time-lapse approach depends on the assumption of the battery's particular state of charge at the beginning of the charge cycle, which is hard to determine, so it typically either undercharges or overcharges the battery.

Optimum detection of full capacity requires increasingly sophisticated algorithms and sensing circuitry, so Enrev technology uses several termination techniques. The foundation of the process stems from the extension of real-time feedback and control, so the intelligent waveform adjusts as the battery approaches full capacity. Measurements of the battery's active components, which are acquired during the application of the charge algo-

rithm, are analyzed by Enrev software to calculate the battery's condition during charge. Because this method is not based on assumptions or estimates, the charging process can be stopped at full capacity without detrimental overcharging. This avoids the necessity of a "topping" charge, which can triple the charge time, to ensure a complete charge.

To demonstrate the technology, the company developed prototype chargers that fully charge a 6V NiCd battery pack to 100% in five minutes with less than 3° of heat rise, and a Li-ion battery pack from dead to full capacity in 45 minutes with more than 2,000 full charge-discharge cycles. Enrev-powered electric vehicle (EV) 200KW charging station charged a battery pack consisting of 26 100Ah/12V PbA batteries to 95% capacity in 18 minutes, while setting the world distance record for electric vehicles. The implications for such speedy delivery of charge can significantly impact the design and usage of many portable products, reduce the cost of ownership and improve emergency preparedness.

Design opportunities

In the past decade, many of the features and functions designed into portable products have been licensed from specialty providers (e.g., Microsoft, Intel, Rambus). In

keeping with this partnership trend, battery operating systems are now moving into the forefront of design-in products. The growing emphasis on battery problems is driving designers to seek creative solutions to the power issue. ACT offers licensing partners a flexible means to address customer complaints.

Enrev technology is embodied in microprocessor software, as shown in Figure 1 on page 28. In addition, it requires a switching regulator and a minimum amount of control and sensing circuitry. As such, the technology can be incorporated into most charger designs, into the portable device's electronics or into the battery housing to realize a true battery-operating system. Enrev technology can be licensed in any form required by a specific application, including object code, a controller with embedded code, an ASIC and rights to use or manufacture ACT circuit or product designs. Furthermore, it is scalable from a small 500mAh Li-ion battery to large PbA battery packs. The software stays the same, only the hardware changes. Enrev technology has already been implemented successfully into the Activators chargers, which are in widespread use in the two-way radio industry.

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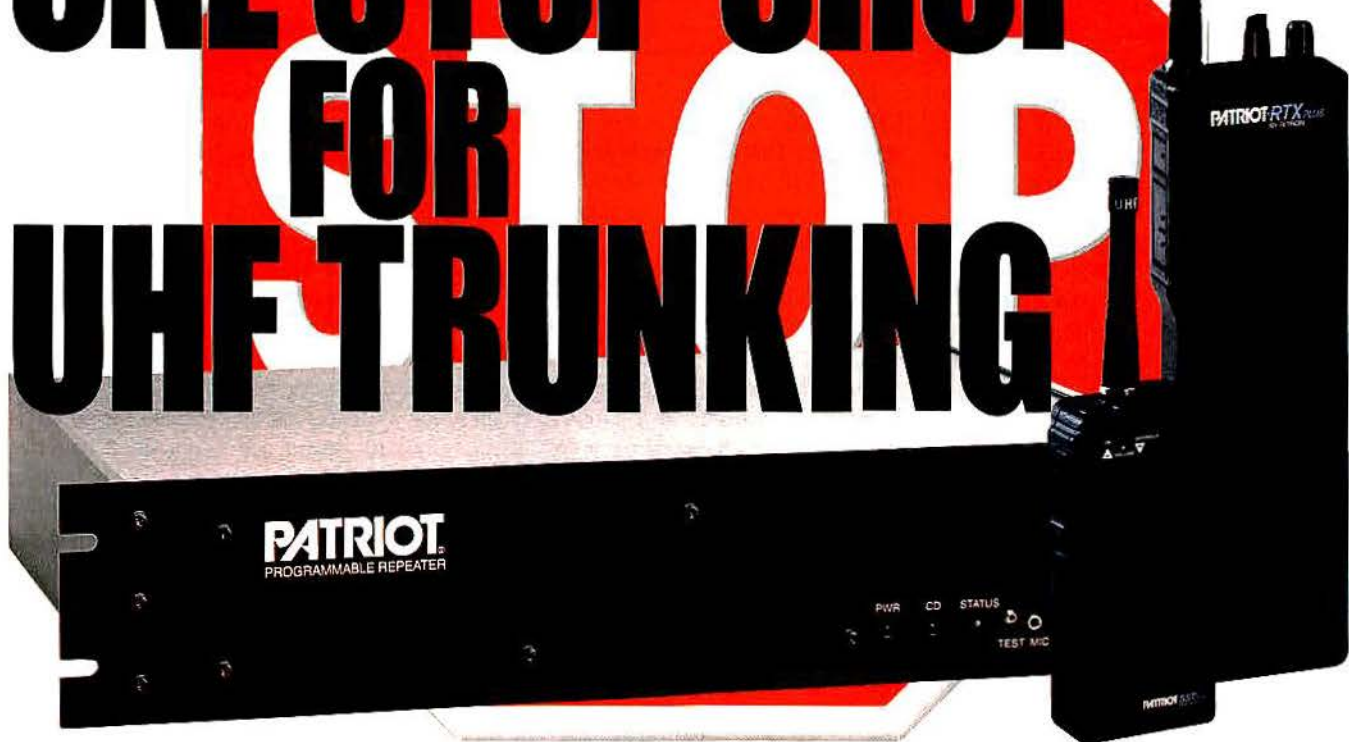
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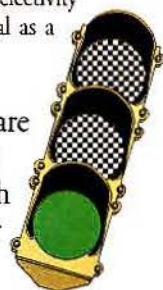
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Cable and fiber optic switching systems, satellite receivers, repeaters and transmission towers all require a steady source of power, as even the slightest interruption in power would cause them to cease functioning (and require expensive reprogramming to start up again).

These systems operate on a steady ac grid with UPS back-up systems in a variety of sizes, locations and configurations. When ac source power is available, these systems convert it into dc to maintain the back-up batteries' state of charge, and then convert the dc back to ac (in some cases) for operation of the system. When ac power becomes unavailable, the batteries immediately begin discharging, continuing to provide dc power to the system or the converting device (inverter) to prevent any interruption of power to the system.

PbA has traditionally been the chemistry of choice for most UPS systems. NiCd is often a better performer, but at a much higher (five times) purchasing cost for batteries. This has often been a stumbling block for UPS users and system manufacturers. Manufacturers cannot justify the substantially higher system cost driven by converting to NiCd batteries, yet customers still demand longer life for the batteries. The paradox is further complicated by the fact that maintaining the batteries using a "float charge" is inherently bad for them.

Manufacturers cannot justify the substantially higher system cost driven by converting to NiCd batteries, yet customers still demand longer life for the batteries.

In addition, the typical remote location of UPS systems makes the cost of maintenance and battery failure extremely high, and predicting battery failure—*before* back-up power is needed—is of paramount importance to most customers.

The patented Battery Management Equalization System (BMES) technology provides a simple, cost-effective method of gauging a battery's state of health before a failure occurs as well as a method of monitoring that information remotely. It answers customer demands for a cost-effective, low-maintenance system, and it solves the paradox of the manufacturers by increasing the life of PbA batteries in UPS systems by a factor of three to five times. With BMES and Enrev technologies, UPS

manufacturers can offer a premium advantage and still use PbA batteries, lower production costs and keep their systems cost-competitive.

Using real-time manipulation of the charge waveform, batteries are maintained and charged in an optimal fashion, significantly improving the reliability of the battery back-up system, providing power to the user when power is needed most.

Conclusion

Enrev software enables breakthroughs in portable product design and establishes new standards for power planning. Designing with Enrev technology can improve manufacturing costs, provide reliable, economical products to customers and reduce the flow of batteries to the waste stream. The benefits of using a lighter, smaller, longer-life battery will result in user-friendly devices that consistently deliver peak performance. Highly sensitive, power-dependent products such as wireless and military devices, and global positioning systems, can be designed for portability with confidence. From smart batteries with embedded charging control to built-in batteries that self-charge, the possibilities are only as limited as the minds of the designers. There will be no more Achilles' Heel for batteries. ■



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Analog multiplex systems: The basics

Part 3 — Active analog mux systems are still in widespread use. An understanding of basic testing and troubleshooting techniques can distinguish a technician.

By Jeff Ashley

Equipped with a basic understanding of analog multiplex (mux) systems, two-way radio technicians can take the leap toward extending their duties beyond base station maintenance and into transmission systems.

This three-part series concludes with a brief discussion of mux system connections, VF and HF considerations and practical testing and troubleshooting techniques.

VF jackfield

External circuits that interface with a mux modem should do so through a VF jackfield. The jackfield allows the "end equipment" (base station, telephone, etc.) to be isolated from the mux modem for testing purposes. There should be jack positions for the MOD, DMOD, and E &

M leads of each mux channel. (See Figure 1.)

The top jacks are wired to the mux channel modem and are referred to as the *line* side of the jackfield. These jacks allow VF level testing into the mux modem MOD or out from the DMOD. The bottom jacks are referred to as the *drop* side of the jackfield. These jacks allow VF level testing into and out of the drop ("customer") equipment. Without any test cords plugged in, the jackfield internally connects the line side to the drop side. If a test cord is inserted into either the line or drop jacks, the internal connection is broken and the two sides are electrically isolated.

The balanced connections to and from the VF jackfield have a circuit impedance of 600Ω. When test equipment is plugged into either the line or drop jacks, the instrument should have an internal *terminating* impedance of 600Ω. Because the line and drop jacks *break* (isolate) the two sides of the circuit, this allows the side under evaluation to be

properly terminated into the test equipment for accurate measurements. A common mistake is to have the test equipment set up in the *bridging* rather than *terminating* mode when plugged into a *breaking* jackfield. This will not offer the proper termination to the circuit, and it will result in level readings being +6dB hotter than what actually exists without the test equipment in the circuit.

Often, a third *monitor* jack is located beneath the VF line and drop jacks. Plugging test equipment into this jack will *not* break the circuit, but it puts the test equipment in parallel with it. In this case, the test equipment must be put in the *bridging* mode to avoid a *double-termination* to the circuit under test. A double-termination will result in readings that are -3dB lower than what actually exists when the test equipment is removed.

When measurements indicate levels are -3dB lower or +6dB hotter than expected, the test equipment *terminating/bridging* mode switch should be checked. The mode

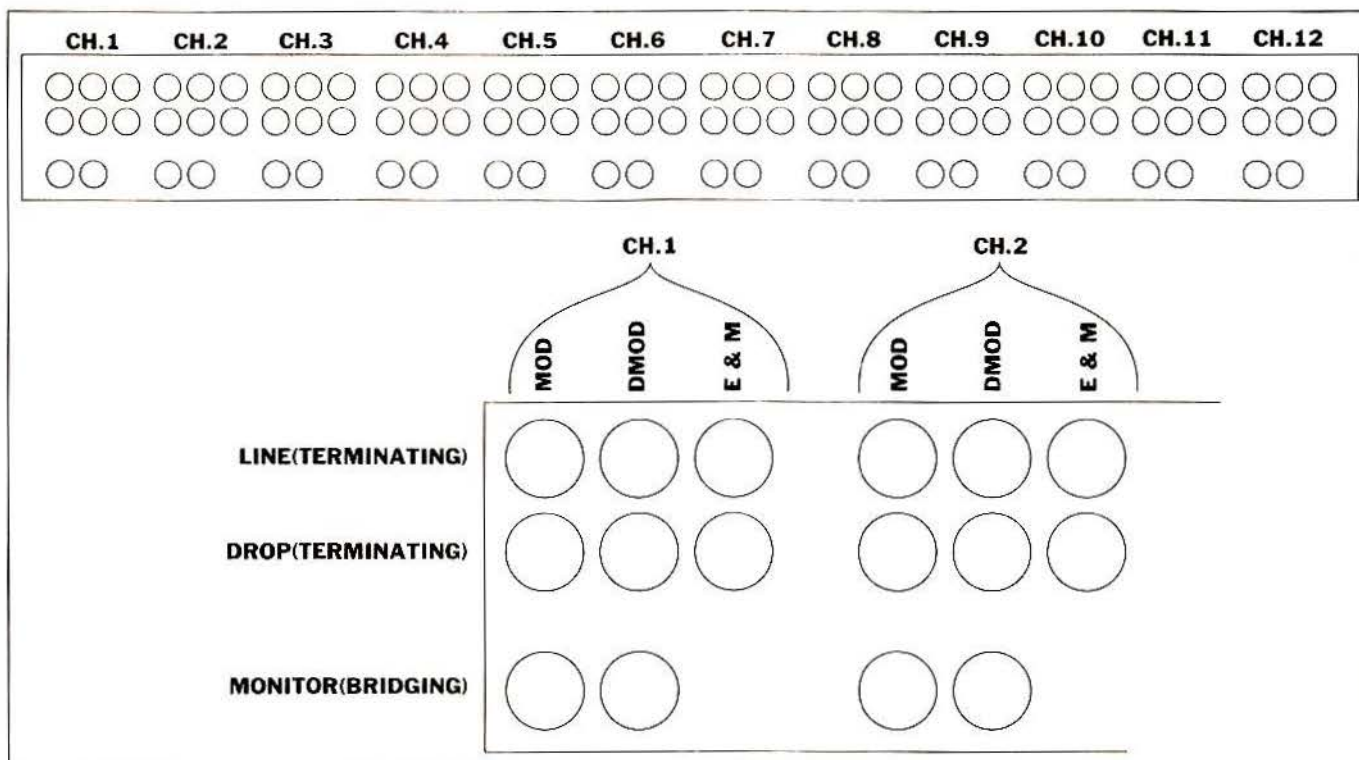


Figure 1. VF jackfield.

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switch only affects the receive portion of the test equipment.

VF test equipment

Serious VF test equipment can accomplish more than just frequency and levels checks. Circuit performance parameters can be obtained from use of a transmission impairment measurement set (TIMS). Test results indicate various aspects of circuit quality. The telephone industry has established standards for many tests such as PAR (peak-to-average ratio), message circuit noise, noise-with-tone, signal-to-noise ratio, three-level impulse noise, phase jitter, envelope delay, noise-to-ground and non-linear distortion, to name a few.

HF test equipment

As the channel modems translate VF signals up to their assigned baseband frequency slots, a method is needed to measure the signal levels of the individual circuits while in the HF frequency range. A frequency selective device is required that can discriminate between the different frequencies on the baseband. Such a device is called a frequency selective voltmeter (FSVM), sometimes referred to as a selective level meter. This piece of test equipment has a variable bandpass "window" that can be tuned to any baseband frequency. It measures the power level (in dBm) of the energy within the bandpass be-

ing viewed. This allows measurement of individual multiplexed channel signals while filtering off all other baseband frequencies. The selective voltmeter can measure broadband (3kHz) or narrowband (about 200Hz bandwidth) circuit levels and typically has both flat and C-Msg weighted filters offering different response characteristics.

A spectrum analyzer is another useful tool for viewing baseband levels. There are spectrum analyzers made specifically for baseband frequencies that have their horizontal baseline calibrated to read in terms of channel, group, supergroup and mastergroup numbers. Test tone level can be calibrated on the vertical axis (signal amplitude, in dBm) so that the whole baseband can be evaluated at a glance with regard to signal levels. Hot levels can be easily identified and zoomed in on down to the channel level.

As a tool in gain/loss measurements, a bridging HF signal generator may be connected to the baseband and used to inject specific tone frequencies at specific levels. The HF frequency, when de-multiplexed, will produce a VF tone in the DMOD of the associated mux channel that occupies that portion of the baseband.

Video (HF) jackfield

The multiplex system baseband connects to a microwave radio through separate receive

and transmit coaxial cables. There should be an HF or video jackfield placed between the mux system and the microwave radio so that the two can be electrically isolated for testing and troubleshooting purposes. A monitor jack is usually provided in both the transmit and receive directions. This allows a FSVM, bridging HF signal generator or baseband spectrum analyzer to be plugged into the jackfield to gain access to the baseband without "breaking" the connection and disrupting traffic.

Potential problems

Maintaining proper signal levels is extremely important within an analog multiplex system. Whether they be externally injected test tones or "live traffic," excessive levels can drive analog mux circuitry into non-linear modes that wreak havoc on the baseband. Hot signals can not only splatter over to adjacent channel slots but produce sum and difference frequencies that affect circuits in other areas of the baseband spectrum as well. As mentioned previously, there should not be any signal on the baseband that exceeds TTL.

Another cause of baseband interference relates to poor shielding or bad solder connections in a mux/baseband assembly. Occasionally, local AM broadcast stations, which operate in the same frequency range as the baseband, can be heard on the baseband along with the mux signals. Although such interference typically affects only one or two mux channel slots, it can render those slots useless for "live traffic."

Analog mux modems also require periodic maintenance. The operating frequencies of their on-board oscillators should be held to within $\pm 5\text{Hz}$ to eliminate problems with translation error.

Conclusion

FDM systems have been in use for a long time. Although many of the latest wireless applications are employing digital technologies, active analog mux systems are abundant and employers need qualified technicians to maintain them. Many of these employers have microwave, mux and base stations at their hilltops and would much prefer having one technician "do it all." With a basic understanding of analog multiplex systems, two-way technicians will find themselves better postured in today's job market. ■

Analog multiplexing series

This is part of a three-part series on analog multiplex systems.

Part 1: "Analog Multiplex Systems: The Basics," April 1999.

Part 2: "Analog Multiplex Systems: The Basics," May 1999.

Part 3: "Analog Multiplex Systems: The Basics," June 1999.

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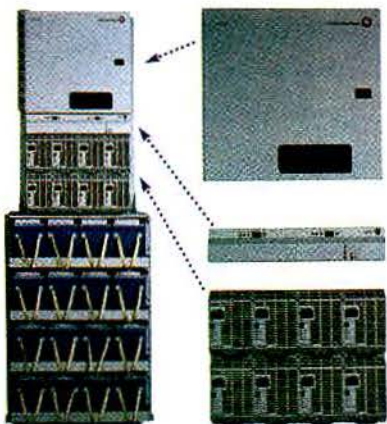
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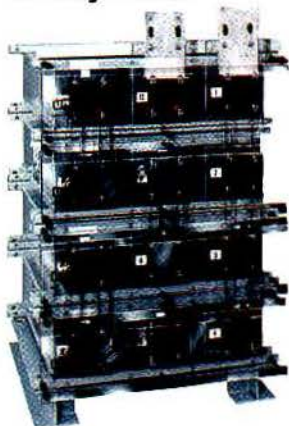
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The FCC wants to auction your privates

What do the left, the right, the eggheads, the anti-trusters and the deregulators in Congress have in common? Despite different motives, they all make the FCC think that it should auction private radio spectrum.

By Robert H. Schwaninger Jr.

In an effort that does not appear to have support from any association, group or individual operator, the FCC has issued a Notice of Proposed Rulemaking (NPRM) in WT Docket No. 99-87, proposing the auction of private radio spectrum below 800MHz. The rules suggested in this auction could create upheaval in business plans, bring an abrupt end to the promise of UHF and VHF trunking and place operators in serious jeopardy.

Released on March 25, 1999, the NPRM seeks comments on issues ranging from the fundamental question of whether the spectrum can be auctioned to the specific procedure that the auction would use. In essence, the FCC is asking, can we do this, should we do this, to whom should we do this, and how should we do this? Press releases from the Utilities Telecommunications Council (UTC), past efforts by Industrial Telecommunications Association (ITA) and public pronouncements by Small Business in Telecommunications (SBT) provide a unified voice in response that answers the FCC in the negative.

Issues

The first issue raised in the NPRM involves the use of private spectrum for public safety purposes and whether the auction is possible, given the statutory prohibition against using auctions for allocation of public safety spectrum. Indeed, this may inhibit the FCC.

Public safety entities have long obtained use of private radio spectrum via interservice sharing for safety of life functions. Local governments operate on industrial channels across the country, and the FCC recognizes that an auction may affect the continuing use of industrial channels by public safety agencies. Without substantial complaint from the public safety organizations, the FCC is likely to deem the auction possible because it will claim that the proposed auction would not (yet) propose relocating or reducing the operational limits of existing public safety systems.

The second issue raised involves whether

changes to Section 309(j) of the Communications Act have created an opportunity for auction of private spectrum, which authority was previously limited to the FCC's auctioning of commercial channels. The answer is likely to be that the FCC has the necessary authority now. However, the FCC is forgetting that the legislative history of those changes included a Congressional admonition to use other methods of licensing.

The third issue is whether the FCC should create separate frequency pools for utilities, railroads and power companies

poses and commercial licenses operating either above 800MHz or pursuant to radio common carrier rules. The FCC is suggesting that applying auctions would be a way of removing those regulatory distinctions.

The final issue is how, if all of the other issues are determined to support auction of private radio spectrum, the spectrum would be auctioned and to whom.

The why of it

To understand why the FCC would propose to auction this spectrum, the forces supporting this move should be examined within the petri dish of legislation. It is a murky environment that is filled with dogmatic viruses that swim against the tides of reason, so follow closely.

First, there is a contingency within Congress that believes that the FCC should be put out of business. It isn't sure how this ought to be accomplished, but it is sure that it ought to be done. The proponents of this position can come from either side of the aisle, and the idea usually is deemed meritorious by the far left and the far right.

The far left thinks that selling spectrum is nifty because the money can go for entitlement programs. It balances the supposed benefits of social security against the benefits of paying for a viable FCC and decide that the FCC can be scaled down. Besides, if the FCC didn't have to do all of that pesky license work, it could accomplish more important things like encouraging minority ownership of broadcast stations and improving children's television.

The far right believes that spectrum equals business, and business is best served when the federal government is not involved. It sees the FCC regulations as intrusive, burdensome and anticompetitive. These proponents want to take the referee out of the ring and let everyone fight it out, relying only on

If the FCC didn't have to do all of that pesky license work, it could accomplish more important things like ... improving children's television.



because their operations may be quasi-public safety in nature. This is a sticky wicket for the FCC. Some of the industrial giants are claiming that their use of the spectrum is too sensitive, too vital and too well-lobbied for allocation by auction.

The fourth issue is whether it is appropriate to remove all remaining distinctions between private radio employed for commercial pur-

Schwaninger, MRT's regulatory consultant, is the principal in the law firm of Schwaninger & Associates, Washington. He is general counsel to Small Business in Telecommunications and a member of the Radio Club of America.

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supply and demand to ensure that the best service wins.

Second, there is the egghead contingency, that visualizes a utopia of operation where the spectrum is used by a few large operators for the good of the American public. These corporate behemoths are supposedly motivated by supply and demand as well, but they are not believed to possess the ability to manipulate either. Rather, they will simply serve as administrators who will take on the duty of making sure that Chucky's Tower Service and IBM each have enough spectrum to operate.

They will serve as administrators who will take on the duty of making sure that Chucky's Tower Service and IBM each have enough spectrum to operate.



Third, there are the anti-antitrust, free-wheeling economist types who believe that all communications are the same and that any regulation that recognizes a difference between forms of

communications for the purpose of delineating markets is simply wrong. Former Chairman Reed Hundt was one of these. His past efforts to deregulate by auction included an underlying assumption that there is no true difference between paging, cellular and microwave. It's all just spectrum for communications.

Finally, there's the deregulation crowd that is seeking to reduce the FCC's administrative burdens above all else. This crowd believes that the FCC should be out of the licensing, enforcement and equipment authorization business. The public is to be served by others or via the Internet. It should not, however, be served by human beings issuing licenses and by decisions that simply clog up the works.

These groups all exist in government, and together they have found a common goal, to shut down the primary function of the FCC by whatever means are most expedient. And the one area they would dearly love to shut down is the licensing of private radio spectrum. It's time-consuming and costly, and it doesn't make the six o'clock news.

What now?
Many readers depend on the availability of private radio spectrum for the operation of their business, either as a two-way dealer using private channels to fuel continued growth or as a private entity seeking spec-

trum to increase the operational efficiency of plants and operations. The NPRM's proposals directly threaten the supply of those channels.

If your livelihood or business is threatened, you must become vocal, active and politically involved in changing the course of the FCC. I suggest the following:

1. Get involved via associations to create a comprehensive, unified voice in objecting to the proposals.

2. Let your objections be known via individual comments to the FCC's proposals.

3. Write your elected officials and tell them why this proposal will adversely affect your business.

4. Get local businesses that rely on radio in your area to contact local, elected officials.

5. Tell elected officials that if they don't go on record as being opposed to this action, no votes, no campaign money, and no future help for perpetuating their job status should be expected.

At this writing, most associations have not fully declared their intentions regarding this NPRM. However, Small Business in Telecommunications (SBT) will be opposing these proposals. I suspect that ITA and UTC will also be banging heads with the FCC over this one, and a number of other groups are likely to step up to let their voices be heard. Even APCO may not be pleased with the FCC's attempt to create



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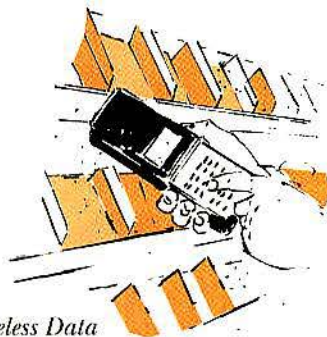
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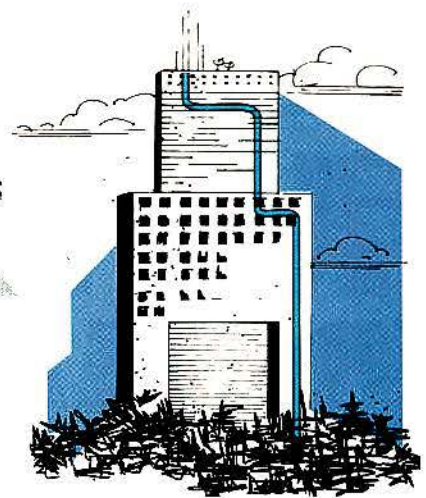
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Investive

Now that you know the whats and whys and hows, it is time for my humble opinion. I, therefore, respectfully and with all deference given to the wonderful people who occupy the honored position of FCC commissioner, ask the simple question, "ARE YOU NUTS?!"

The labyrinth of licenses that include the pri-

vate radio spectrum make a bowl of spaghetti look organized. The channels are shared, narrowed, overlapping, waived, adjacent, non-contiguous, paired and unpaired, historically divided into service areas, subject to a bushel of treaties, and serve areas as big as the continental United States and as small as single plant. But with one wave of a magic auction wand, it is expected that order will come from chaos and peace will reign in the land.

There are varying limitations on height, power, use, geographic location, number, availability, service areas and coordination responsibilities. Litigation, complaints, interference, bogus equipment and pending business plans exist that depend on continued certainty

in the allocation of private spectrum. Yet, all of this will go away because something proposed to be called a "band manager" will step forward, offer a few million dollars at auction, and do all of the work that the FCC used to do.

There are laws, protections, acts and precedent extending back to 1927 that protect the rights, duties and responsibilities of licensees to assure the provision of efficient

services to the American public. But all of these will become historical footnotes because all future licensing (which used to be within the exclusive jurisdiction of the FCC for the purpose of serving the public interest) will be a function of arms-length negotiations between a band manager and someone begging for channels.

Underlying these sweeping and unrealistic assumptions are some flawed premises:

1. The public is best served by the biggest entities.
2. All telecommunications service should come from commercial operators.
3. There is a direct relationship between money offered to the federal government and service to be provided to the American public.

Under the FCC's proposal, band managers will buy bands of channels at auction. Then they may do with the spectrum as they like, including leasing use of the channels to others to construct and operate facilities. Those leases would expire when the band manager's license expires. This forced consolidation of market power is so anticompetitive that it flies in the face of every known antitrust case since Teddy Roosevelt.

The FCC proposals, if adopted, would require that local distribution companies must go begging to the band manager in direct competition for use of spectrum that might otherwise be targeted by larger concerns. Chucky's Towing would then be in competition for use of channels with Yellow Freight. Let's guess who's going to win that one when the band manager has no obligation to even take Chucky's call.

If the FCC hasn't learned its lesson from the PCS Block C auctions about money and sincerity in serving the public, then I'm tempted to recite the story about the farmer, the mule and the two-by-four for the purpose of getting one's attention. Let's make this clear. He that puts up the dough doesn't have any greater incentive to produce a viable

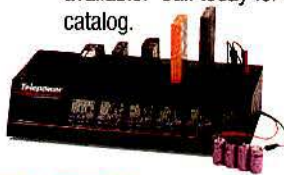
With one wave of a magic auction wand, it is expected that order will come from chaos and peace will reign in the land.



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service than the guy that gets it for free. The federal court in the recently decided *Fresno Mobile Radio, et al. v. FCC* didn't buy that argument, and I don't either.

Perhaps my biggest objection can be summed up succinctly by saying that these proposals are lousy for small business and lousy for industrial concerns. Small businesses would be deprived of spectrum unless they were willing to kowtow and pay an entity for the privilege of using radio. Industrial operators would be frozen in spectrum availability, unless they were willing to spend investment dollars for spectrum rather than production and distribution. Either way, the American public is shafted.

Either the public will lose the benefit of competitive services from small business, or it can pay higher prices for goods and services to offset higher costs of operation of plants. For this multibillion-dollar price, the public will receive some paltry shekles in the proposed auction and an FCC that has just assigned its primary function to a private entity. Notice that I didn't say anything about lower tax or spending burdens. There is nothing in the NPRM that suggests that if this proposed regimen becomes law, the FCC will refuse a higher operational budget in the future.

Will this happen?

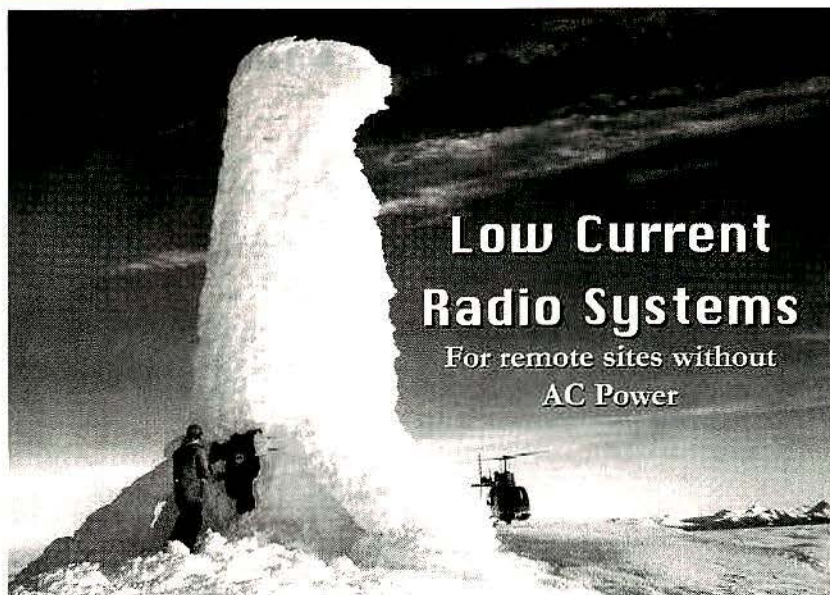
I don't know. I was the idiot who said that the FCC would never even propose anything this stupid. If you want to make sure it happens, do nothing.

When the FCC wanted to auction the SMR channels, many operators did nothing. They assumed that the FCC would do whatever it wanted and that their opinion meant nothing. *Wrong.* If the industry had gotten off of its collective duff, banded together based on principal rather than old, time-worn allegiances, and had stated in a unified voice "No," the FCC would have had great difficulty in moving toward auction.

Instead, many non-SMR operators acted as though that fight had nothing to do with them. Well, that rulemaking was the precursor to this one. So, sticking one's head in the sand has been shown to be a faulty strategy because the FCC has shown its shovel.

There's one more thing that will ensure that this NPRM becomes law: capitulation of principals to achieve political expediency. The issues raised by the FCC are an invitation to infighting among groups, as each tries to lessen the impact for its constituency. This only works if we let it happen. Each adversely affected group should fight against these proposals and not try to cut a separate deal for a unique segment. We should not divide so the agency can conquer.

I'm ready if you're willing to see this fight through. This is bad politics, bad law, and bad economics that won't benefit anyone. If you need help, call me. At least you know where I stand. ■



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Regulations may restrict the use of fossil fuels for backup power at remote telecommunications sites. Some high-efficiency alternative power sources are both environmentally friendly and operate at a reasonable cost.

By Donald E. Koehler

Do you have a remote site—one fed by ac mains but with a backup power source? Or one with a diesel generator as the prime power source? Are you planning a new site or major upgrade to an existing site and your tenants demand a solid standby power source? New, updated and changed federal regulations may have an expensive impact on your plans if you choose to use a diesel generator. New and changed regulations may affect your use of motor fuels. Several new, high-efficiency power sources now exist, and upcoming technology could have a positive impact on your bottom line.

Unless you regularly work with environ-

mental regulations, you may not be familiar with some of the new restrictions placed on above-ground fuel storage tanks (AST), waste oil handling, battery stacks and in certain cases, exhaust gases. For a more detailed look at these federal regulations, all of which are available on the Internet, see the list on page 48.

The listing shows the maze of regulations that kick in when you use a motor fuel generator set as a prime or reserve power source. This may explain the rise in popularity of solar systems.

An immediate cost and regulatory savings may occur if you switch your generator fuel to Compressed Natural Gas (CNG), propane, butane or other LPG or natural gas. Waste methane can be used as an energy source in

some locations, and it may have tax incentives or tax breaks. If you have access to ac mains as a prime power source, you will still want a backup power source. A hybrid of a battery stack and ac charger/inverter (UPS) may work if your need for standby power is short-lived or limited. An additional short-coming is the weight of the battery stack and potential for regulation under the "Community Right to Know" (SARA title II or III), section 101, 102 or 103. This rule deals with extremely hazardous materials (EHM)—battery acid in this case.

Further clouding the issue are remote RF sites in occupied buildings where the National Fire Code kicks in. Batteries generate explosive gases so they usually have their

Contributing editor Koehler has more than 30 years' experience in radio, telephony and computer electronics. He has been teaching part-time at the University of Alaska, Anchorage, for the last four years. His email address is afdek@uaa.alaska.edu.

Federal environmental regulations affecting power sources and fuel choices

Spill Prevention, Control and Countermeasure Plan requirements (federal & some states)

Oil Pollution Act of 1990

NPDES/Stormwater Permit Regulations

DOT Pipeline Tank Regulations (some sections may apply)

Clean Air Act of 1970

(exhaust gases and "furtive" tank emissions)

Clean Air Act Amendments of 1990

Risk Management Program

SARA Title III and CERCLA Section 103 (battery stacks)

Resource Conservation and Recovery Act — Used Oil Regulations (from servicing generators)

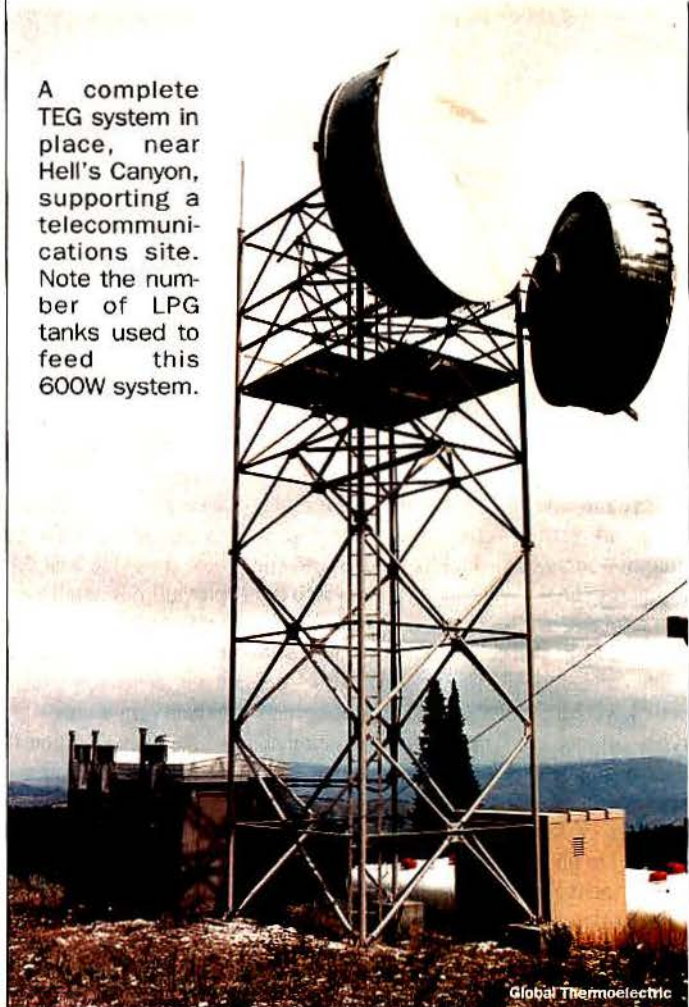
OSHA Standards for Flammable and Combustible Liquids (motor fuels in generators)

OSHA Hazard Communication Standard (a requirement for employee safety)

EPA (EPCRA) Community Right to Know (SARA title II and III)

OSHA Confined Space Rule (for large tanks)

A complete TEG system in place, near Hell's Canyon, supporting a telecommunications site. Note the number of LPG tanks used to feed this 600W system.



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Circle (42) on Fast Fact Card

Power technology Web sites:

Zinc-air battery technology: www.aern.com/rd.htm

Al-air battery technology: <http://peacekeeper.kosone.com/alum.htm>

TEG systems: www.globalte.com/generators.htm

General fuel cell technology information: www.fuelcells.org/fuel/fctypes.shtml

own rooms and the presence of large amounts of sulfuric acid tends to make landlords nervous. Many of these rules and regulations come out of tragic and unnecessary fires, explosions or loss of life caused by these regulated devices.

If you're ready to throw in the towel, smile, things are getting better. New energy technology—some sponsored by the Department of Energy (DOE)—is making its way into the marketplace. The first of these "new" technologies is the fuel cell. Often associated with "outer space" or the movie, *Apollo 13*, fuel cells have come a long way. One of several types of fuel cells may be an economical source of power for your site—either as a primary or backup supply.

Types of fuel cells found on the current market are phosphoric acid, proton exchange membrane (solid polymer), molten carbonate, solid oxide, or alkaline. Phosphoric acid systems, especially those used in co-generation systems are often primary power sources for large computer systems, hospitals or isolated

building complexes. Efficiencies as high as 85% are not uncommon. The Alaska National Guard, for example, has had such a system in use since 1997 without a hiccup—powering an office complex and the state disaster communications complex. See the photos at www.dodfuelcell.com/richardson.html. Fueled by natural gas, which is *not* burned, the 'waste' heat is used to heat the building complex and provide domestic hot water. These types of units, properly sized, make a prime choice for those urban sites where you want to replace a noisy generator, reduce waste oil and reduce exhaust emissions.

Another common fuel cell on the market is the proton exchange membrane (PEM). Most technical staffs are aware of these cells in the marketplace—the byproduct of the energy generation process is water, water you could drink. Using hydrogen and air as feedstocks, PEM cells offer high-power density and small size. Any 'waste' heat can be vented or used to regulate room/shelter temperatures. The DOE claims that you will soon see this

type of fuel cell at home, in your car, as a battery supply for cellphones or even to run your camcorder. Other fuel cell types are still in development or are for large applications, not suited for a communications site.

If you have a remote site, a hybrid system of solar panels and a thermoelectric generator (TEG) in tandem to charge a battery stack/inverter combo is a solid economic choice for those sites where access is a problem for some part of the year. This type of system is in daily use by the U.S. Air Force at several remote Alaskan sites (www.nwvt.com/PB_Kollsman.html) to power a ground system. Fueled annually, when the ground is frozen solid, the TEG provides both power and heat. In the summer months, solar arrays and almost 24 hours of sunshine fill the energy needs of the system. TEG manufacturers, such as Global Thermoelectric (www.globalte.com/index.htm) offer a wide range of systems in different output (heat and electricity) ranges. Another TEG supplier, Hi-Z Technology (www.hi-z.com/) offers entire systems or TEG modules so you can construct your own system to recover waste heat. Both will use CNG, natural gas, propane or butane—allowing a wide choice of supply.

The final class of "new" technology energy sources are zinc-air and aluminum-air batteries. These types of batteries do not use an acid electrolyte—a brine solution in conjunction with high purity metal electrodes delivers the current for a backup power source or to supplement your charging system. While most cannot be recharged, the waste stream is easily handled. Known for their small size and high energy densities, these batteries may find their way into your automobile sometime soon; for communications applications they are now an "off-the-shelf" product available in different voltage and current ratings.

The communications site owner/operator, whether in the rural countryside or deep in a city high-rise, now has a choice for energy supplies without using internal combustion engines or heavy, acid-laden batteries. Green and clean products, ranging from TEG systems to esoteric metal-air battery systems, are available as proven off-the-shelf technology giving low-cost, high-density energy solutions. ■

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The following pages contain mobile radio, paging, cellular products and services of advertisers in this issue. Information is provided by the advertisers. For more information on these products, circle the corresponding Fast Fact number found on the card on page 85, or contact the advertiser directly. Also, refer to the Advertiser Index on page 84 for the page reference to the company's advertisement.



Equipment supply

AF CommSupply has equipment from more than 65 industry manufacturers, including Andrew, Celwave, Decibel, Times Microwave and PolyPhaser in stock and ready to ship from the warehouse in Kansas City, MO.

Circle (301) on Fast Fact Card



Battery equipment

BatteryPro Systems manufactures battery recharging, conditioning, analyzing and maintenance equipment. The equipment features simultaneous processing of as many as 252 batteries. Inventory control software with barcoding is also available.

Circle (302) on Fast Fact Card

Hand-held receiver

The Mongoose from Berkeley Varitronics Systems is a lightweight, hand-held receiver that is suitable for quick, indoor sweeps by propagators. It weighs less than five pounds with the rechargeable NiCd battery. The internal memory stores signal strength that can be output to a PC with a serial cable. Audio can be heard through the headphone jack or the internal speakers.



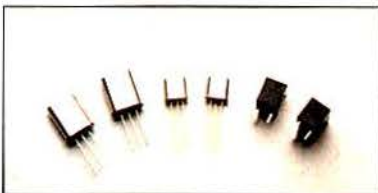
Circle (303) on Fast Fact Card

Dipole antenna



ESMR, cellular, paging and PCS operators now have an easier way to optimize their systems. The Celwave Optimizer, a log periodic dipole antenna, offers continuous adjustment of electrical downtilt with the simple turn of a dial. One Optimizer operates over a frequency range of 1,850MHz-1,990MHz and has an 11.5dBd gain and a 90° horizontal beamwidth.

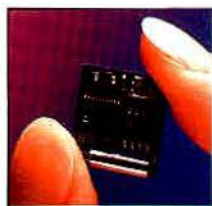
Circle (304) on Fast Fact Card



Crystal Filters

Communication Specialists produces low-cost, exact-replacement narrowband crystal filters for 10.7MHz, 11.2MHz, 11.7MHz, 21.4MHz, 21.8MHz and 45.05MHz. For more information, visit the Web site at www.com-spec.com for the complete catalog and product descriptions

Circle (305) on Fast Fact Card



ANI encoder

Control Signal introduces the ID-12 ANI encoder, which features the Motorola MDC-1200 format. The encoder includes leading and trailing ID, emergency and time-out timer. The ID-12 is small (0.59" x 0.65" x 0.12") and works in any radio. A field programmer or factory programming are available. Call 800-521-2203.

Circle (306) on Fast Fact Card



Coaxial protectors

RF coaxial protectors from Citel feature N, 7/16 DIN, TNC, SMA connectors, less than 0.1dB at 4GHz, gas tube and quarter wave technology. The protectors are suitable for radio, wireless base stations, transmitters, and they automatically reset after every surge.

Circle (307) on Fast Fact Card



Portable radio system

Daniels Electronics' portable radio system is used to implement a temporary base or repeater station. It is small, water-resistant and lightweight. The built-in battery and charger allow the system to operate at a 5% duty cycle at 4W output for about eight hours.

Circle (308) on Fast Fact Card



Base antennas

DAPA Communications designs, manufactures and implements base antennas for wireless applications (806MHz-960MHz and 1.710MHz-1.990MHz). The Accubeam series features upper-side lobe suppression and lower null fill. Camouflage services are now available in the United States. For details call 1-800-325-DAPA or visit www.dapa-com.com.

Circle (309) on Fast Fact Card



Direction finder

The 6000/6100 series radio direction-finding systems from Doppler Systems feature 2° accuracy, operating range 125MHz to 1,000MHz. Software facilitates data acquisition from multiple sites and features real-time triangulation of signal source locations on digital maps.

Circle (310) on Fast Fact Card



Narrow notch

The Eagle TNF-400 tunable filters provide <0.7% notch width with notch depths of >30dB. Frequencies available are 10MHz to 500MHz. Units will pass up to 1.0GHz. Package size is 3" x 2". Call for free application note. 520-204-2597.

Circle (311) on Fast Fact Card



Lightning protectors

Huber+Suhner's 3409 series lightning protectors combine two technologies: shunting frequencies outside their tuned band to ground and passing dc voltage. The gas capsule self-extinguishes after a surge when carrying high RF power. High power cannot change the capsule performance or cause ignition.

Circle (312) on Fast Fact Card

HUTTON OnLine

Web site

Hutton Communications introduces *Hutton OnLine*. The Web site provides access to detailed product information and pictures for more than 14,000 products from more than 120 manufacturers. Search for products by part number, keyword or product category; compare like items side by side; and place orders any time at www.huttoncom.com.

Circle (313) on Fast Fact Card



Wireless testing

With the acquisition of the former Marconi Instruments and IFR complete, IFR is a wireless test provider. The company's radio test sets, spectrum analyzers and signal generators are used to design, install and maintain cellular, PCS, SMR, private wireless, paging and microwave applications.

Circle (314) on Fast Fact Card



Mobile radio

Intek Global's Midland brand Titan mobile radio is customizable with 320 channels, nine scan types, 9600 baud, 2.5 channel stepping, 12.5kHz or 25.5kHz channel spacing and alphanumeric display. For more information call 1-800-699-4567 or visit www.intekglobal.com.

Circle (315) on Fast Fact Card



Digital radio camera

The KVT-10 is the rugged Kenwood digital radio camera capable of sending images from one portable to another. Connecting to most popular radio models, the KVT-10 captures and sends digital images to another radio attached to a KVT-10.

Circle (316) on Fast Fact Card



Stored voice unit

Motorola introduces the Minitor III stored voice unit. This is the latest product for fire and EMS service. The unit is synthesized, has two minutes of storage and six-call capability. Call McManus Communications at 888-763-7550 for more information.

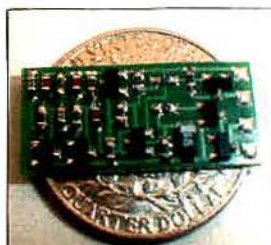
Circle (317) on Fast Fact Card



Survey meter

The model 8715 survey meter from Narda combines ease of operation with measurement capabilities. The meter can also make precise, spatially-average measurements critical for the collinear dipole antenna arrays common in modern wireless communication systems.

Circle (318) on Fast Fact Card



Monitor board

Paging & Wireless Service Center has developed a monitor board to retrofit existing pagers without a squelch circuit to monitor the channel. Physically, it is a small, printed circuit board that can be installed inside Motorola Keynote and Director II pagers.

Circle (319) on Fast Fact Card

RITRON, INC.

Radio communications equipment

Ritron is a U.S. manufacturer of radio communications equipment. Products include Jobcom job-site radios, VHF low/high and UHF conventional and LTR/Passport trunking portables, mobiles and repeaters. Other products include wireless telemetry systems and RF data modules. Ritron is a family-owned business headquartered in Indiana.

Circle (320) on Fast Fact Card



Wind turbines

Southwest Windpower manufactures battery charging wind turbines for individual, commercial and industrial clients in more than 40 countries. Introduced in 1998 as a response to industry demand, the AIR Industrial charges batteries on tower, offshore and mountaintop repeater sites.

Circle (321) on Fast Fact Card

Hand-held radio



TEKK's NT-8/9 hand-held radios offer 5W output, 15 channels, scan, priority scan CTCSS/DCS and 25kHz or 12.5kHz operation. All units come with a three-year limited warranty, 1,100mAh battery, belt clip and antenna. The radios are available in VHF and a UHF frequencies.

Circle (322) on Fast Fact Card



Weather alert radio

The Weather Eagle 100 from Thunder Eagle is a professional grade weather alert radio. It uses patented, field-proven technology to automatically find the best NWS signal and digitally record warnings into the receiver with a date and time stamp. Other models place weather alerts your communication system. www.thunder-eagle.com.

Circle (323) on Fast Fact Card

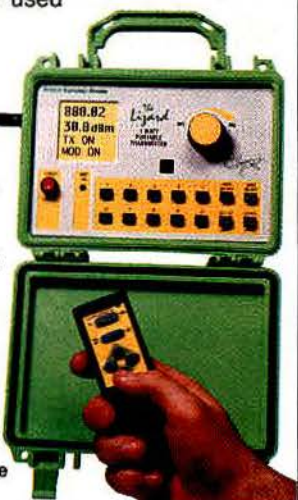
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Circle (44) on Fast Fact Card



RXR series amplifier

TPL Communications offers the RXR Series, a family of reliable, cost-effective, continuous-duty amplifiers. This package will accept any TPL amplifier, low band through 960MHz, output levels to 120W. It includes a circuit breaker and on-off switch. It is also available with a fan and dc power supply.

Circle (324) on Fast Fact Card



Inverter

Tripp Lite Powerverter ultra-compact de-to-ac inverters provide 120V ac power wherever and whenever needed by harnessing the battery power of automobiles and RVs. Powerverter ultra-compact inverters supply power for laptop computers on the road, household appliances at campsites and small power tools at worksites.

Circle (325) on Fast Fact Card



A member of
Bird Technologies Group

Collinear array antenna

TX RX Systems, a division of Bird Technologies Group, is offering three versions of its broadband collinear array antenna for the 860MHz-960MHz range. Each model is an antenna featuring bandwidth and pattern consistency, along with 1,000W power handling capability.

Circle (326) on Fast Fact Card

Visit MRT's Web site at www.mrtmag.com for an overview of the current issue of the magazine and a preview of next month. The site also provides subscription information and an article index to locate articles based on subject matter.

Send your questions or comments to mrt@intertec.com and let the editors know what you think.



RF power amplifiers

VOCOM Products designs and manufactures RF power amplifiers specializing in high-efficiency power amplification for FM-modulated communication systems. Customers include wide-area paging providers, community repeater operators, and state and federal government agencies. www.vocomrf.com.

Circle (327) on Fast Fact Card

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Minitor II and KeyNote are a reg. trademark of Motorola Inc

Circle (53) on Fast Fact Card

IDEN remote control



The Zetron Z370 is a desktop remote that controls an IDEN radio located as far as 2,000 feet

away. Whether the user is calling a talk group or just checking for mail, the Z370 is easy to understand. For facilities with multiple dispatch points, the remote provides additional functions.

Circle (328) on Fast Fact Card

IWCE disseminates technical, regulatory, product info



Schwaninger

Virostek

More than 10,000 wireless industry professionals gathered in Las Vegas Apr. 28-30 for the 23rd Annual International Wireless Communications Exposition. Attendees browsed the displays of more than 350 exhibitors and audited a wide variety of business-, technology- and regulatory-related conference sessions.

Special sessions included the RF Design Seminar series and base station workshops. The regular conference business track covered wireless data, specialty wireless applications and dealers' use of the Internet. The regulatory track examined auctions and licensing, and FCC rules and regulations for European radio. The technology track dealt with analog-to-digital migration, solar photovoltaic power and new antenna technology. Both the FCC Forum and "Industry Leaders Meet the Press" were well-attended sessions.

Plenary session

Robert H. Schwaninger Jr., MRT's regulatory consultant, addressed the opening session on "State of the Industry Report—Cash and Chaos Theory 101." He offered views on topics ranging from 800MHz relocation agreements to CALEA. (See page 18.) Schwaninger said many of his clients were making higher and higher profits by selling dispatch radio and gravitating to cellular. "They could make more," he said, "if they only had more spectrum."

Keynote speaker Steve Virostek, vice president of messaging and dispatch at The Strategis Group, an industry analysis firm, presented a breakdown of conditions in the private radio market. Virostek said private radio communications equipment was still a big business with sales of \$2.2 billion in 1998. The number of private radio users reached 16.3 million in 1998, roughly 13% of the U.S. workforce. Leading users of non-commercial spectrum were businesses, at 61% of total users, government

agencies at 13% and public safety at 10%. Virostek said projections show narrowband analog radio sales should climb over the next five years to represent about 23% of all units sold in 2004. Virostek also said that the greatest obstacle to the growth of the private radio industry is the lack of clean radio spectrum to accommodate additional use.

FCC officials announced two changes in bureau activities at the show. They announced a postponement of enforcing a new policy of rejecting without prejudice improperly completed license applications. The original effective date of May 1 is being postponed to allow the FCC time to more widely publicize the change to licensees and potential licensees. Riley Hollingsworth, Compliance and Information Bureau (CIB) legal advisor, also announced that the CIB is now ready to increase involvement in interference issues affecting the land mobile bands.

Potential private wireless auctions

To respond to regulatory activities occurring after the program had been set, a special general conference session was added to IWCE the afternoon of April 29. The session focused exclusively on the implications and repercussions of a recent FCC Notice of Proposed Rulemaking (NPRM) (WT Docket No. 99-87). The NPRM examines how the FCC may implement changes to its statutory auction authority outlined in the Balanced Budget Act of 1997. The NPRM is seen by industry observers as a harbinger of auctions in private wireless spectrum. [Editor's note: Comments to the NPRM are due 60 days following the docket's publication in the Federal Register, which occurred on May 3. On May 12, the Land Mobile Communications Council filed a request for extension to file comments. The FCC routinely grants such requests for a 30-day period, so comments will probably be filed through late July. See, "The FCC wants to auction your privates," page 42.]

Panelists for the

special session were Laura L. Smith, executive director, government relations, for the Industrial Telecommunications Association (ITA) and Robert H. Schwaninger Jr. of Schwaninger & Associates, general counsel to Small Business in Telecommunications (SBT). Both panelists noted that the NPRM does not contain any specific proposed rules that would expand auctions into current private wireless bands, but contains numerous questions about use of the spectrum by private wireless licensees. The attorneys characterized the NPRM as more of a "Notice of Inquiry" by the FCC, and urged the attendees to work through their trade associations to present a uniform front to the FCC that can indicate that changes explored in the NPRM are "a bad idea."

The Radio Club of America hosted a breakfast meeting at IWCE on April 29. Featured speaker Jay Kitchen, president of the Personal Communications Industry Association, spoke about some of the key regulatory issues that affect the radio business. He said the four key issues were re-farming, 800MHz wide-area licensing, private spectrum allocation and private spectrum auctions. Kitchen gave an evaluation of each issue.

It was not all work and no play in Las Vegas. An International Reception the evening of April 28 was well-attended by many of the 1,100 international delegates attending IWCE. MRT, Wireless Technology International and Site Management & Technology hosted a barbecue for exhibitors after they had finished booth setup on the April 27. Kenwood, Trident, Icom, Ritron, Maxrad, Intek Global, Dataradio, Telewave, IMTA and RFS Cablewave also hosted receptions throughout the event.



After a long day of setting up a total of 355 booths, exhibitors relax and enjoy a barbecue in the Las Vegas Hilton, sponsored by Intertec Publishing.

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Merger, compliance issues highlight SBT 'jam session'

Small Business in Telecommunications (SBT) and SMR WON announced the merger of the two telecom trade associations during an SBT "jam session" seminar held one day prior to the International Wireless Communications Expo in Las Vegas.

In the surprise joint announcement by Lonnie Danchik, chairman of SBT, and Walter Gallinghouse, secretary-treasurer for SMR WON, the two industry leaders said the absorption of SMR WON into SBT was prompted by overlapping interests in industry regulation and competition issues affecting land mobile communications business operators, as well as some duplication of membership. The merged organization will continue as SBT.

SMR WON was formed in the fall of 1994, primarily as a response to the FCC freeze on 800MHz SMR licenses and to attempt to block auctions of that spectrum. In February,

the U.S. Court of Appeals for the District of Columbia upheld the FCC's auction authority for 800MHz.

SBT was organized in March of 1996, focusing on a broader range of issues facing small telecommunications businesses, such as paging, interconnection, SMR and various regulatory issues. Its voting membership is restricted to businesses with annual revenues less than \$20 million.

Danchik later said issues involving merging the officers and boards of the two organizations will be resolved at their next scheduled business meetings.

McCain to address SBT

Also announced at the SBT seminar was an affirmation from U.S. Sen. John McCain (R-AZ) to appear as the keynote speaker at SBT's fall seminar in St. Louis in September. McCain is chairman of the powerful U.S. Senate Committee on Commerce, Science and Transportation, which oversees telecommunications legislation. He also is an announced candidate for the Republican Party presidential nomination.

Full program

Seminar sessions, introduced and linked by SBT General Counsel Robert H. Schwaninger Jr., covered contract negotia-

tions for 800MHz relocation in the upper 200 channels, and efforts by Mobex Communications to have the federal courts enforce the 1994 U.S. Department of Justice consent decree affecting competition by Nextel Communications in major markets.

Other topics included interconnection negotiations between paging operators and local exchange carriers, FCC auction participation and procedures, universal licensing, local number portability, the Communications Assistance to Law Enforcement Act, 450MHz trunking and the FCC's recent NPRM regarding auction authority and private wireless.

Seminar sponsors, which also provided brief presentations to the attendees, included ComSpace, Electro-Comm Distributing, DX Radio Communications, Vic Jackson Interconnection Services, Kenwood Communications and Communications Equity Associates.



More than 230 people participated in the SBT session.



Lonnie Danchik, SBT, and Walter Gallinghouse, SMR WON, finalize the merger of the two associations.

ITA unveils automated frequency coordination

The Industrial Telecommunications Association, Arlington, VA, announced the introduction of "Netlicense" at a press conference held Wednesday, April 28, at IWCE.

Netlicense is an automated system for processing private wireless FCC applications and concurrent frequency coordination certification requirements. The system initiates both the process of submitting FCC Form 600 application data and engages the necessary spectrum analysis programs, which streamlines the entire frequency coordination process. The system can be accessed via the Internet at www.netlicense.org.

Netlicense may be used to apply for either a new license or the modification of an existing license. When an applicant, who must be an ITA member, completes the necessary application data, that information automatically commences application initiation and frequency coordination procedures.

Anritsu presents hand-held spectrum analyzer

"I lost 26 pounds in Vegas," was touted by Anritsu's Microwave Measurement Division, Richardson, TX, because of its introduction of a hand-held spectrum analyzer at IWCE, on April 28.

The MS2711 stood out as a new product with a weight of 4 pounds. Designed for field environments and applications requiring mobility, the analyzer satisfies spectrum analysis needs in PCS, paging, cellular, WLAN/WPBX and other communications system applications. The battery-operated unit covers the 100kHz to 3,000MHz frequency range.

The hand-held analyzer offers synthesizer-based performance, delivering measurements anywhere and at anytime. A broad range of functions coupled with narrow-resolution bandwidths to 10kHz makes it suitable for finding the source of interfering signals in modern wireless systems. The analyzer features 90dBm sensitiv-

ity, ≥ 60 dB dynamic range, ± 1.5 dB amplitude accuracy and phase noise performance of ≤ -74 dBc/Hz.

Users are able to store 10 setups along with 200 measurement traces internally in the unit's nonvolatile memory. The stored data can be easily downloaded to a PC or a printer via an RS-232 serial cable. A notebook computer can be used with the RS-232 interface for automated control and data collection. A modem can be used for remote operation.



The MS2711 enables testing over the 100kHz to 3,000MHz frequency range.

Transcrypt International reduces prices, plans new products, receives additional orders

Demand for the Transcrypt International's business and industrial radio communications products declined in the first quarter of 1999 because of increased price competition.

"We have adjusted prices to be competitive," said the company's new chairman, Michael Jalbert.

Transcrypt plans to introduce new encryption modules in a wide range of mobile radios and telephony products. Its EFJohnson Division introduced, in the first quarter, a line of Project 25-compliant digital mobile radios, and it intends to introduce new models of hand-held land mobile radios in the fourth quarter.

The company's \$9.7 million first-quarter revenue is a decrease of 55.8% compared to \$22 million for the same period last year. The loss for the quarter was \$4 million, compared to a net income of \$1.3 million for the comparable period in 1998.

Although Transcrypt faced continued weakness in systems sales, lacking any large new domestic systems contracts during 1998, it was awarded two systems contracts for \$6 million in March 1999. Those orders will bring future revenue. International sales declined in the first quarter, primarily in Latin America. Operating expenses improved by \$1.3 million compared to the first quarter last year.

Jalbert said, "Management's attention and energy is now focused on our customers and markets. Our top priorities going forward are revenue growth, a return to profitability and liquidity."

Additional orders came to Transcrypt during April.

The first is for \$1 million worth of encryption modules to secure the radio communications system of a Western European national police organization.

George R. Spiczak, newly named as senior vice president and general manager for Transcrypt's Information Security segment, cited the company's "superior product offering and technical skill to interface products" into almost any communication system as reasons why the company won the order. Spiczak arrived April 22 from Microdyne, Alexandria, VA, where he had worked for Jalbert as senior vice president of operations.

On April 28, at the MRT-sponsored International Wireless Communications Expo, Transcrypt announced that its EFJohnson Division received \$3.7 million in new orders from current customers "recently." The orders from five customers include the expansion of and the addition of simulcast sites on current public safety systems, upgrades to system infrastructure and additional subscriber units.



Jalbert

IMTA ranks trunked systems by 25 largest in world; Nextel ranks No. 1 in United States

Research by the International Mobile Telecommunications Association, Washington, finds the largest markets for commercial trunked radio are Canada, Germany, Japan, the United States and the United Kingdom. For lack of accurate information on operators in China, no Chinese operators are included on the list—though some might have qualified. Many subscribers also are found in Argentina, Australia, Brazil, France, Malaysia, Mexico, South Korea, Spain and Turkey.

IMTA research shows 4.5 million more units in use in 1998 compared to 1994. It predicts another 20 million subscribers by 2005, thanks to high loading levels that digital systems achieve relatively quickly and their anticipated growth throughout the world. In the United States, almost 2.5 million digital units are expected to be in service by 2000, according to "The State of SMR and Digital Radio" published by the American Mobile Telecommunications Association (AMTA) and Strategis Group. IMTA estimates that 3.4 million of the 8.6 million subscribers recorded in 1998 were digital units. By 2000, IMTA anticipates that the number of digital subscribers will surpass analog sub-

scribers worldwide, accounting for more than 8 million subscribers.

Great demand remains for conventional and trunked analog systems in large cities and rural areas. Several manufacturers, such as A Communications, ComSpace and SmartLink Development, have developed technologies that allow analog systems to offer more sophisticated services, achieve greater capacity and provide coverage over wider areas through networking.

Among North American operators, Nextel (United States) ranks No. 1 with 2.96 million subscribers. No. 5 is Clearnet Communications (Canada) with 154,627. No. 8 is SouthernLinc with 100,000. No. 9 is Comunicaciones Nextel De Mexico with 80,000. No. 12 is Mobex Communications (United States) with 60,000. No. 16 is Delta Comunicaciones Digitales SA. de C.V. (Mexico) with 35,200. No. 18 is Elyps Dispatch Solutions (Canada) with 30,000.

The full list is available at www.imta.org/storyofweek.html. The system rankings were determined solely by the number of subscribers each system has to date, not on capacity or coverage.

FCC Notes

FCC clarifies PLMR rules

The Commission will continue consolidating the radio services below 800MHz in the interest of more effective and efficient use of the Private Land Mobile Radio (PLMR) spectrum, as it released in April in a second memorandum opinion and order. The commission also clarified various aspects of the consolidation rules.

The second MO&O addresses the pending requests for reconsideration and clarification, except those related to the trunking rules and potential interference to medical telemetry systems, which the commission will address in the future. Eligibility in the public safety pool is limited to those entities that were eligible licensees under any of the former public safety radio services and the special emergency radio service.

The order also affirmed the reliance on the frequency coordination process, rejected arguments that, with consolidation, the traditional expert and impartial service of frequency coordinators will be compromised, and declined to regulate the frequency coordination process more restrictively.

The order clarified several aspects of the rules regarding licensees operating on the low-power 12.5kHz offset channels in the 450MHz-470MHz band and made limited provision for the use of wide-band equipment on low-power offset channels and clarified the rules regarding the stations from which applicants proposing trunked systems must obtain concurrence.

Hospitals granted waiver for SERS

Seven hospitals have filed requests for waiver asking the commission to grandfather their existing Special Emergency Radio Service (SERS) paging systems operating on certain 453MHz frequencies. Each of the hospitals contends that it meets at least one criterion for a grant of a permanent waiver permitting the continued operation of its existing SERS paging system. Specifically, the hospitals contend that relocation of their respective paging systems would disrupt public safety communications. Based on the record established in each case, the FCC concluded that these Requests for Waiver should be granted to permit them to continue their one-way medical paging systems on the subject frequencies in the 453MHz band. This action services the public interest because the hospitals' migration to other paging frequencies would pose unnecessary risks to essential medical paging communications without significant public interest benefits.

Uniden Private Radio focuses on manufacturer's reps, distributors

During the past year, the Private Radio Communications Division of Uniden America, Fort Worth, TX, has found it necessary to respond to the destabilization of foreign currency markets in Asia and Latin America. Uniden now sells mostly through representatives and distributors. It now has fewer direct sales employees and more indirect sales representatives.

Among those exiting the division during the past year are Kazuo Suzuka, the division's executive vice president; Jon Osler, international sales manager; and Glenn Gordon, marketing manager. The number of employees let go was not released, but a source close to Uniden put it at 15, leaving the division with eight employees. Some remaining employees moved up in the process; among them, Ken Armbrust was promoted to national sales manager.

Sal Farina, who advanced from domestic sales manager to vice president of sales during the period, explained what he characterized as the division's slight change in focus.

"Uniden is trying to have all of our sales and distribution U.S.-based," he said. "We still service international customers, but we have consolidated sales and distribution to the

United States." Among the U.S.-based distribution centers Farina identified are Beam Radio, Hutton and Lenbrook Industries.

Last year, Farina's predecessor, Yasuhito Hara, said that the division sought a revenue increase of 20% during 1998 and another 20% in 1999. Hara since has moved up to vice president of the division. Although Farina did not comment about the division's revenue change for last year or its current revenue target, he talked about business prospects involving conventional two-way radio, 450MHz trunking, 800MHz analog trunking and the fresh FCC rulemaking about private radio spectrum.

"Growth has come in conventional market share," Farina explained. "We also have grown in 450MHz trunking, which we didn't have a year ago."

Regarding 800MHz trunking, he said, "the 800MHz market has softened considerably because of Nextel pressure," adding that the pressure includes not only Nextel's marketing but the frequencies and spectrum the company controls.

A competitor, Lincoln, NE-based Transcrypt International, stated in its 1998 annual report that Nextel's conversion of analog systems to digital is making a large

amount of used 800MHz equipment available. Farina agreed that the used equipment inventory is interfering with sales of new systems in the United States. On the other hand, he said that, internationally, 800MHz is "stable."

Regarding the FCC rulemaking in WT Docket No. 99-87 that might result in auctions of private radio spectrum, Farina said that Uniden's main customer base is the land mobile radio dealer.

"Any auction scenario or any spectrum allocation scenario would have to have the dealer as a primary participant. We favor any plan that brings spectrum to that dealer. They would benefit financially," he said.

Last year, two companies were supplying narrowband (5kHz) two-way radio equipment, Datamarine International, Mountlake Terrace, WA, and Intek Global, New York. A third, ComSpace, Irving, TX, had taken its narrowband development to the prototype stage. Uniden has a narrowband technology, that has not yet deployed. The company is not committed to deploying its technology in favor of using another that might become more widely accepted—ComSpace's, for example.

"We follow ComSpace's progress step by step," Farina said. "We are interested in anything that would increase spectrum capacity. Our customers would welcome that."



Farina



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News Notes

DX Communications has announced that its **DX Radio Systems Division** has separated from the parent, **TPL Communications**, Los Angeles, and has been incorporated as **DX Radio Systems**. It was decided that as separate entities, both divisions would be able to better focus on their respective product lines: for **DX Radio**, repeaters, and for **TPL**, amplifiers.

A.C. Data Systems, Coeur d'Alene, ID, and **Transtector Systems**, companies that make surge protection equipment, have settled their pending patent litigation. (www.surgeblox.com)

On May 6, **Nextel Communications**, McLean, VA, and **MCI Worldcom** called off merger talks. Four days later, **Microsoft** agreed to invest \$600 million buying Nextel stock and to enable Nextel customers to access a customized set of Internet services offered through a co-branded version of the MSN portal.

SmartLink Development Network, Apex, NC, has received certification from the **Communications Committee of Russia** for its **SRMLink** trunking system and components. "One of the main demands of Russian customers is telephone interconnect through trunking controllers," said **Sergey Pugatchev**, chief executive of SmartLink's Russian distributor, **Bermos**. With certification, orders have increased "significantly," a statement from SmartLink reads. (www.smartlinklp.com)

Coded Communications, Carlsbad, CA, ceased operations February 17. Inquiries at 800-228-6367 are referred to **Steven W. Spence** at fax number 302-655-4210. The Web site was still active in April. (www.coded.com) ... On April 16, more than 50 rural utility representatives from 15 states came to Kansas City, MO, for a **National Rural Telecommunications Cooperative (NRTC)** informational session and product demonstration of its 220MHz Wireless Communications Program. "Rural utilities nationwide have come to understand that a shortage of spectrum suitable for wireless communications is looming in the near future," said **Charles Horton**, NRTC's director of wireless systems. (www.nrtc.org)

To add to its line of passive broadcast RF products, systems and services, Orland Park, IL-based **Andrew Corp.** has acquired Maine-based **Passive Power Products**. Where wireless infrastructure sales have been slow for Andrew, digital television (DTV) infrastructure construction is expected to grow, hence the acquisition. Andrew said it may reduce its worldwide workforce of 4,000 by 10%-12%. (www.andrew.com)

AML Communications, Camarillo, CA, a maker of multicarrier and towertop amplifiers, is cutting 25 jobs (27% of its roster). (www.amlj.com)

On April 29, **California Microwave**, Sunnyvale, CA, changed its name to **Adaptive Broad-**

band, the name of a company it acquired on Aug. 20, 1998. On Nov. 19, 1998, the company acquired **Crown Satellite**. Hardly resting, the company announced on March 11 the expected sale of its defense business to Los Angeles-based **Northrop Grumman** for \$93 million at closing and as much as \$5 million more in 2000 if certain revenue goals are met. The company's **Microwave Data Systems** division in Rochester, NY, is known for MDS point-to-point radios for public safety communications. (www.microwavedata.com) ... The **Ministry of Information Industry** of the People's Republic of China has certified MVP modular voice processing system for interconnectivity with China's public SS7 and MFR2 telecommunications networks. MVP is made by **Glenayre Technologies**, Charlotte, NC. Also, the company has shipped "the majority of product" under an \$8.3 million contract with the Long Distance and Mobile Business Group of **ChungHwa Telecom**, Taiwan, to upgrade and expand its nationwide Flex paging network. Meanwhile, **Golden Eagle Credit**, Ridgefield, CT, is helping Glenayre to in turn help carriers to offer a leasing option for two-way pagers. Furthermore, Chairman **Ramon Ardizzone**, commenting on the Glenayre's loss of \$45.2 million for 1998 compared with earnings of \$26.6 million for 1997, said: "We have made the right expense adjustments to support the volume of business we expect." (www.glenayre.com, www.goldeneaglecredit.com)

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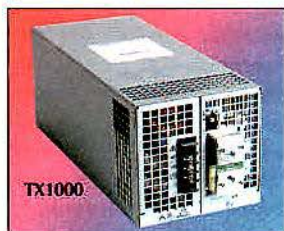
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Power supplies

Power supply offers active input power factor correction circuitry



C&D Technologies' power electronics division has developed the TX1000 power supply, a single-output, 1,000W power supply with active input power factor correction (PFC). The active PFC circuitry provides compliance with EN-6100-3-2, and it accommodates a wide-input voltage range of 90Vac-264Vac for global applications. The PFC input stage is followed by a two-transistor forward converter, which provides a proven architecture for high-reliability requirements. It also features EMI compliance to FCC/CISPR22 Class A requirements.

Circle (351) on Fast Fact Card

Digital uninterruptible digital power system features 3.5-inch height



Clary's DT (digital technology) series of uninterruptible power systems are a thin, digital, true-online UPS. The 19" rackmount chassis is 3.5" tall. The DT series is the first all-digital UPS from Clary offered

as a standard product and is the basis of other UPS models. The units supply continuous digital power reliably through brownouts, dirty input ac and loss of input ac. Features of the DT series include software-selectable configuration, automatic bypass, cold start with no ac present, outputs that can be controlled remotely or from front panel and power factor correction to near unity. The DT series consists of a family of five UPSs ranging from 800VA to 2000VA, all available in either a 19" rackmount or a tower enclosure.

Circle (354) on Fast Fact Card

Supplies feature extra output filtering



ICT offers more than 300 switching power supply versions with output current ranges from 4A to 100A. Features include input and extra output filtering for a virtually noise-free operation, a high efficiency

MOSFET design, fuse protection, current limiting, a diode protected output for battery backup and a terminal block connector. A line of base station series wrap-around covers individually customized with various models of mobile radios are also available.

Circle (352) on Fast Fact Card

Power module system uses off-the-shelf components



NEWMAR's power module/power function manager system provides versatile building blocks that enable the communication site engineer to customize a fully integrated and economical power system using off-the-shelf components. Power modules feature a variety of configuration choices including 115Vac/230Vac input, 12Vdc, 24Vdc or 48Vdc output, positive, negative or floating ground. They also feature 560W or 1,000W per module (up to 6,000W per system), parallel or N + 1 configuration, power supply or battery charger function

and three-step charging, equalization and temperature compensation charger options.

Circle (353) on Fast Fact Card

UHF, VHF base station power supply receives safety approval

Samlex America's base station power supplies feature a UL listed to U.S. and Canadian safety standards and a three-year limited warranty. They comply with FCC part 15 class B standards. They also have a



switched-media design and are designed for HF, UHF and VHF transceivers. Models include 10A and 23A with optional radio enclosures. Custom-designed radio cabinets integrate mobile radio and power supply to create a functional and attractive desktop base station unit. The units can be used with products from Motorola, Maxon, Vertex, and Kenwood.

Circle (355) on Fast Fact Card

Supply covers wide range of apps

Todd Products' series of low-cost, single- and multiple-output power supplies is designed for computers and office automation equipment. The single-output power supplies are available with 65W or 85W ratings. The dual-output models are available with ratings of 40W, 50W, 60W, 65W, 70W and 85W. The triple-output models are available with 65W or 85W ratings, and the quad-output model is an 85W power supply with four outputs. Among all the models, the available outputs range from 3.3V at 10A to 48V at 1.8A, covering a wide range of applications. The units are offered in industry-standard 3 x 5 or 2 x 7 footprints. The power supplies accept universal power input from 90V to 265V, 47Hz to 63Hz, single-phase ac and 120Vdc to 370Vdc.

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products

READERS' CHOICE

Of the new products in the October 1998 issue, this one generated the biggest reader response. For more information on this product, circle the corresponding Fast Fact number on the card found in the back of this issue, and mail the card to us.

Radio kit offers instant field communication

The portable Emergency Radio Communications Kit from **Kenwood Communications** is designed for instant set-up and use. The kit includes radios and essential accessories to use for disaster management communications. The collection of two-way radio equipment is self-contained in a rugged case with wheels, sized for easy handling and air freight. The kit includes a Kenwood TM-V7A dual-band base station, capable of voice and APRS (automatic position reporting system) when used with a GPS

receiver and TH-G71A dual-band portable transceivers. Kenwood Freetalk portables are included for short-range communications. A compact and lightweight switching power supply, mag mount antenna and gang charger are also packed in the kit. An accessory package with spare NiCd battery, AA alkaline battery case, speaker microphone and earphone and cigarette lighter power adapter are incorporated into a waist pack. Kenwood Radcam is also included.

Circle (500) on Fast Fact Card

Antenna handles voice, data transmissions



Antenna Specialists' Medallion series of low-profile antennas for vehicular and fixed wireless data applications

handle voice and data transmissions and are recommended for critical communications situations. Fixed data applications include tracking package shipments, meter reading and other data transfer functions. Providing omnidirectional coverage, the antenna features unity

gain and 10W power rating. The groundplane-dependent design makes them suitable for transit buses, police cars, firefighting trucks, airport service vehicles and construction equipment. These broadband antennas cover 806MHz-960MHz (ASPG8891). Both are compatible with a male/female mounting system, series K-166, which allows for a choice of cable and connector, as well as simple replacement of existing whip-style antenna installations with a 3/8" or 3/4" hole mount.

Circle (401) on Fast Fact Card

Public safety software works on Microsoft

HTE's Microsoft SQL Server 7.0 version of its Policeworks and Fireline products automates dispatch, record management, communications and field reporting requirements for public safety agencies. SQL Server 7.0 includes financials, community service, K-12 administration, utilities and

public safety and justice—on the Microsoft platform. This relational database management system runs on the Microsoft Windows NT Server operating system. The system is designed to help leverage a government technology investment.

Circle (402) on Fast Fact Card

Transmitter housed in protective enclosure



The Stingray transmitter from **Berkeley Varitronics Systems** is a self-contained laboratory instrument housed in an EMI/RFI protective enclosure. The salient components of this stimulus transmitter are a dynamically controlled power amplifier and the ability to remotely control all of the transmitter's parameters via a PC. Remote adjustments include the power level, channel and frequency assignment and transmit on and off.

Circle (403) on Fast Fact Card

Antenna analyzer covers paging, SMR bands

Anritsu's Microwave Measurement Division's Site Master S400A is a broadband

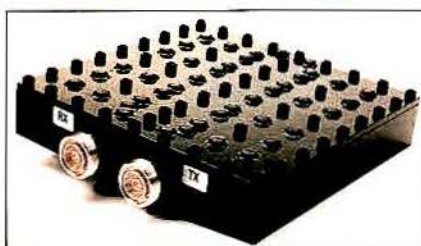


one-port transmission line and antenna analyzer. The analyzer covers the SMR, PMR, paging, broadcasting, AMPS/DAMPS, GSM 900/1,800, PCS 1,900, ISM and WLL frequency bands. The analyzer can reject external RF interference, allowing the 8" x 7" x 2.25" instrument to accurately measure antenna systems from the ground in dense RF environments. Covering the 25MHz to 4GHz frequency range, the analyzer features built-in distance-to-fault, return loss and cable loss measurement functions. The instrument's internal memory saves as many as 40 traces, and the synthesizer is accurate to 75ppm. An RF watt meter/power monitor is optional.

Circle (404) on Fast Fact Card

Duplexer offers selective RX, TX combining

Narda West's band duplexer (part number SFD-41A-a819-02) provides selective receive and transmit combining. It is designed to pass the full PCS receive and transmit bands while providing more than 60dB isolation. Out-of-band rejection is 60dB minimum from dc to 1,825MHz and greater than 55dB from 2,015MHz to 4,000MHz. The units have a 1.0dB maximum passband insertion loss with 0.8dB typical. Power ratings are 200W continuous duty, 750W peak, with multicarrier powers of eight carriers at 12W



each. Passband return loss is specified at 14dB maximum.

Circle (405) on Fast Fact Card

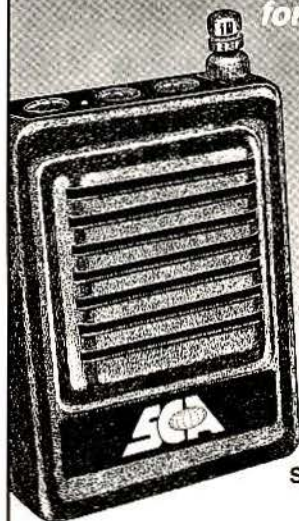
Radio modem offers built-in diagnostics

Johnson Data Telemetry's T-96SR radio modem provides data rates of 19200 baud in a 25kHz channel and 9600 baud in a 12.5kHz channel. The modem provides a high-spec radio covering VHF, UHF and 900MHz MAS frequency bands. It supports the Dataradio interoperability standard (DIOS), providing full compatibility with the JDT T-96S, Rnet 9600 and 9600S and the Dataradio T-modem and the T-base base station repeater. The modem provides the user a path to meet the future efficiency standard in place by NTIA, and contemplated by the FCC. The modem provides built-in diagnostics to aid users in maintaining the health of their data communications networks. System statistics can be gathered with each transmission on-line while the application is running. These on-line diagnostics can indicate a problem before a costly system failure occurs. Should the on-line statistics raise a question regarding performance, more in-depth information can be gathered through the off-line diagnostics.

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Portables available in safe versions



Vertex Radio Communications' high-spec, rugged VX-510 series land mobile portables are available in low-band: A, 29.7MHz-38MHz; B, 38MHz-50MHz; VHF: C, 148MHz-174MHz and UHF: D, 450MHz-488MHz. The portables meet MIL-STD 810 C/E/E ratings and are available in intrinsically safe versions. All versions feature a full 5W RF power output rating with low-power level settings of 1W. DCS/CTCSS is pro-

grammable by channel as well as 12.5kHz/25kHz channel spacing. The portables are capable of 32 channels and offer several scan modes. They are 5" x 2.3" x 1.5" with battery. The portables have a die-cast frame and 1,700mAh high-capacity battery pack that offers a 13.3-hour duty cycle. A four-character, high-intensity invertible alphanumeric display is included.

Circle (407) on Fast Fact Card

Bandpass filter isolates VHF channel



The model 11990N bandpass filter from **Microwave Filter** isolates a VHF channel while maintaining a low loss of 0.5dB maximum at the final output of the transmitter. It can be custom-tuned to any VHF high-band frequency (channels 7-13) and is available for different channel formats. The filter has a video-audio separation of 6.5MHz. VSWR is 1.3:1 maximum. Rejection is 20dB \pm 12.5MHz from the center frequency. Impedance is 50 Ω , and connectors are type N female. The unit handles 500W of power. As an option, units can be ordered with 7/8" EIA flanges for power handling as high as 1,000W. It is 18.25" x 16.30" x 5.0" and is designed for indoor use.

Circle (408) on Fast Fact Card

Headset with boom mic offers peripheral hearing

The Lite headset from **Television Equipment Associates** protects hearing and is versatile. The headset has both a boom-mic and a throat-mic. When gas is deployed, the user can quickly plug in the throat mic and achieve voice quality while using gas masks. The headset offers peripheral hearing: Gaps around the earphone let the user hear ambient sound as though there were no obstruction—a requirement for close quarter battle. It fits comfortably under ballistic helmets. The headset accommodates any ear defender installed on top

of the headset to protect the user's hearing from concussion and explosive entry without detracting from communications. The headset is comfortable with a foam cushion that envelops the user's ear and fabric and elastic straps that maintain stability on the head.



Circle (409) on Fast Fact Card

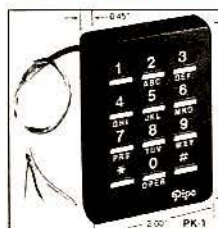
Two-way pager system offers real-time service

Datalink's interactive two-way pager system includes real-time transaction services. The technology creates an interactive link between a subscriber carrying a two-way wireless device, such as an advanced messaging pager, and the wireless network server. The two-way system allows subscribers to instan-

taneously respond to an alert by sending a predefined message, either via wireless, email or fax, to one or more parties as well as to query an information server to receive real-time information. Users can query an information server and receive a response on the pager.

Circle (410) on Fast Fact Card

Encoders offer reliable contact system

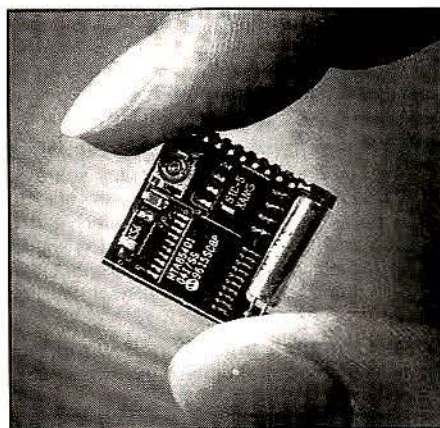


The PK series of encoders from **Pipo Communications** feature a reliable contact system that tolerate high and low temperature extremes over a prolonged period of cycling. The units offer waterproof and dustproof sealed gold dome contacts and steel keys. They are operable from 4.5Vdc to 60Vdc at temperatures from -22° to 160°F. The output level will drive any trans-

mitter or system and is adjustable by a stable multiturn trimpot, with access from the front of the encoder. The K-series option has a built-in keying circuit to automatically key a transmitter or other system. The M-series option is a special encoder package for mounting any PK-1, PK-1K, PK-2 and PK-2K encoder to surfaces that are inaccessible from the rear, such as walls, mobiles, dashboards, panels, systems interface and test equipment. The M-series option consists of a detached frame that is secured to the mounting surface.

Circle (411) on Fast Fact Card

Digital ANI (Unit ID) Motorola® MDC-1200® Format



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Manufactured by **Control Signal®**, the ID-12 ANI encoder is a cost-effective way to upgrade all the radios in your fleet with ANI that is compatible with Motorola MDC-1200. Works in all radios, and its tiny size (.59" x .65" x .12") allows it to fit in virtually all hand-helds. Has leading and trailing IDs, emergency, and time-out timer. Fleet price (100 qty) \$89 ea. Dealers: Call for pricing.

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Circle (38) on Fast Fact Card

Wireless system offers voice connectivity



Metric Systems' Instantoffice is a plug-and-play wireless system for providing wide-area, point-to-point and multipoint voice and data connectivity to remote offices in urban or rural locations.

The system combines everything needed to provide single or multiline dedicated or dial telephone services and high-speed router-based secure Ethernet and data services. The system integrates the unlicensed 2.4GHz Pathfinder 2000 256kbps wireless data transceiver and the Mavric 2000nx wireless router/controller with Mediatrix's voice over IP adapter to enable anyone to build simple point-to-point or complex multipoint systems across the street or across the country. The system features a point-to-point range of five miles standard and 20 miles with a long-range antenna option. Circuit types supported include an IP packet-switched and permanent virtual circuit. The wireless security is virtually undetectable and undecodable because of long PN spreading code.

Circle (412) on Fast Fact Card

Combiner offers 200W-per-channel capability

A compact, high-power trunking combiner from Celwave is available in two models, uses integrated waveguide cavity technology and offers 200W per channel capability. The combiner also features integrated loads on isolators with sampling ports. Designed for high-power trunking systems, the robust 10 1/2"-high unit displayed no damage after running for hours at more than 170W per channel with the antenna connector deliberately shorted or

open-circuited. The combiner requires no coaxial cables between its components, and it features integrated sampling ports, integrated isolator loads and precise compensation. The unit (identified as models HIW860-5S and HIW860-6S) allows in-service diagnostics. Other features include an open- and short-antenna port capability under power and optimal performance over power and temperature.

Circle (413) on Fast Fact Card

Adapter kit carries high power at high frequency



RF Connectors' RFA-4013 7/16 DIN adapter kit offers advantages for the N or SMA connector interface. Capable of carrying high

power at high frequencies, the 7/16 DINs are large, precise and offer stable electrical and mechanical connections with tight tolerances and improved VSWR performance. The adapter kit offers a convenient means to bridge type N devices to 7/16 DIN interfaces on the test-bench and in the field. This foam-lined, zippered kit contains six adapters:

RFD-1653-2, 7/16 DIN male to 7/16 DIN female R/A adapter; RFD-1653-2, 7/16 DIN female to 7/16 DIN female barrel adapter; RFD-1670-2, 7/16 DIN male to N male adapter; RFD-1671-2, 7/16 DIN male to N female adapter; RFD-1672-2, 7/16 DIN female to N male adapter and RFD-1673-2, 7/16 DIN female to N female adapter. All are made of machined brass and feature Teflon insulation and silver-plated contacts and bodies for minimal intermodulation generation. Applications for the connectors include the cellular, PCS, GPS and digital communications fields with requirements for the connector interface.

Circle (414) on Fast Fact Card



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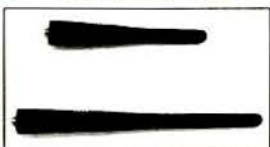
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Circle (46) on Fast Fact Card

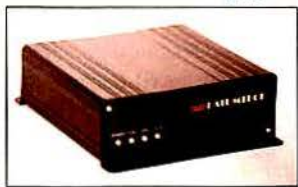
Portable antennas offer smaller size

Centurion International's SX antennas can be as much as 20% shorter than standard antennas at the same frequency. Industry-standard injection-molded antennas, with a frequency bandwidth of 150MHz-161MHz, measure 6.5" long. The SXB 155MZ, in the same bandwidth, is an inch shorter at 5.5". The durability of the antenna is increased because of a capless sheath construction. Without the usual cap on the tip of the antenna that can fracture under stress situations and with the integrity of the continuous sheath design, these antennas offer ruggedness while retaining flexibility. The sheath design also features a dimple at the tip of the antenna, and it has a finish and profile that matches newer radio designs. The VSWR rating is less than 1.5:1 at resonance frequency.

Circle (415) on Fast Fact Card



Interface supports AVL systems



Veridian's Datumtech Operations' intelligent data interface (IDI2) adds intelligence to automatic vehicle location (AVL) systems using wireless networks. The interface is compatible with cellular digital packet data (CDPD), satellite transceivers,

BellSouth Wireless Data (RAM mobile data) and any data-certified radio system. For systems that use radio frequencies for communications, the interface uses advanced slotted accordant polling (ASAP) to provide efficient, high-speed polling rates (as many as 20 vehicles per second) and multiplexing of AVL and mobile data communications (MDC) information. For systems that use CDPD or other packet-based systems, the interface incorporates an event-based reporting scheme. The unit monitors user-defined activity and automatically alerts the operations center when configured parameters are met.

Circle (416) on Fast Fact Card

Amplifiers offer digital control tech

The TSLPA series linear power amplifiers from Bravo Tech are designed with advanced RF and digital control technology. They provide power, linearity, efficiency and system flexibility in trunking, cellular and wireless local loop systems. The intelligent digital control system constantly fine-tunes the amplifier to ensure operation over a wide variety of electrical and environmental conditions. The amplifiers meet FCC requirements for system transmissions under multitone or multichannel conditions and can be fed as many as 16 channels with a maximum intermodulation distortion of -60dBc. A single power module provides 50W average output power, and can be expanded to 200W with multiple modules. All systems are in a standard 19" rackmount chassis.

Circle (417) on Fast Fact Card



TDR finds faults on power cable

Riser-Bond Instruments' model 3400 is a rugged hand-held metallic time-domain reflectometer that enables power technicians and contractors to locate faults on power cable. The waveform TDR test complex live low-voltage networks and de-energized medium- and high-voltage cable. Design features include an overlay mode for comparing stored and live waveforms, a mains blocking filter with model 40 fused test leads, providing as much as 450Vac protection, and high-energy rechargeable batteries that keep the TDR instantly ready for service calls.

Circle (418) on Fast Fact Card

Arrester uses gas discharge tube

The Antenex Trapper lightning arrester is available in an inline or bulkhead mount and protects RF equipment. The gold anodized arrester limits surges to 45V in about 100ns. A gas discharge tube changes from an open circuit to a short circuit in the presence of voltage surge, giving those surges a direct path to ground. The arrester is designed with a rugged, yet attractive housing with plated brass N connectors and a user-replaceable gas discharge tube. From 0MHz to 1,000MHz, one model covers the entire LMR spectrum, insertion loss is less than 0.1dB to 500MHz, and greater than 0.25dB up to 1,000MHz.

Circle (419) on Fast Fact Card



LTR controller software upgraded

Connect Systems has upgraded the software for the LTR controller model LT-4200. Designated as Stock #LT-SPP (STR system priority programming), this alternate software allows the LTR service operator to set certain priorities for sequencing radios through this system. LT-SPP provides a method of separation of portable users and mobile users to operate on specific channels without the need to reprogram any of the user's radios. Another application allows adding channels to an existing LTR system without reprogramming the existing radios to the new frequencies. The radios added to the system would be set to trunk on all channels, but the original radios on the system would be restricted to their existing programmed channels.

Circle (420) on Fast Fact Card



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Circle (58) on Fast Fact Card

Color brochure describes terminal



Globalcom Systems has published a color brochure on the Explorer II portable statphone with ISDN capabilities. Explorer II is a third-generation Inmarsat-B land-mobile, high-speed data and voice terminal. It is priced less than the cost of previous Inmarsat-B transportable systems and has many new features. The brochure highlights these features and provides color photographs.

Circle (451) on Fast Fact Card

Catalog offers installation, lightning protection accessories

Andrew has published the second edition of its *Coaxial Cable Installation Accessories* catalog. The catalog features sections on cable installation accessories, lightning protection products and other value-added services. New sections cover installation aids such as the Easiac Plus automated cable preparation tool and new services for installers including PCS/cellular systems planner software and terrestrial microwave systems training. The pages give short product descriptions, photographs, line drawings and part numbers. The appendices contain hints for selecting installation products, lightning strike statistics and definitions.

Circle (452) on Fast Fact Card

Web site features RF products

Spinner North America has created an on-line presence at www.spinnerna.com. The Web site provides information on Spinner's 7/16 coaxial connector groups, jumper cables as well as broadcast equipment and RF transmission equipment. An additional feature is the company's contact page that lists email addresses for Spinner North America personnel and sales representatives as well as key contacts at the headquarters facility. The site also provides a direct link to the company headquarters' site, and product overviews are available from the initiating source.


www.spinnerna.com

Book focuses on DECT and PWT

Personal Wireless Communications with DECT and PWT from Artech House covers background material and technical principles, basic protocols and implementations, plus advanced features and the wide range of applications. John A. Phillips and Gerard MacNamee have written this book explaining how DECT (digital enhanced cordless telecommunications) and PWT (personal wireless telecommunication) work, plus an overview of products and services. The book shows how history and previous technology have shaped these standards, the best ways to implement DECT and PWT for private indoor speech and data systems, as well as for outdoor public access telephony and the basic architectures and fundamental principles.

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people



Campbell



Walker



Blain



Lang

W. Ed Campbell joins Centurion International, Lincoln, NE, as chief financial officer after more than 20 years of financial management experience with manufacturing companies throughout the Midwest.

John C. Walker departs River Oaks Furniture, Belden, MS, as vice president of finance to join Hutton Communications, Carrollton, TX, as chief financial officer.

Bruce Blain leaves the ATI Wireless division of the Alpharetta, GA-based World Access as regional sales manager to join NEC America's microwave radio department, Irving, TX, as account manager for the eastern U.S. region.

J. Jay Lang, CPA, joins Nations Media Partners, Kansas City, MO, as general counsel and corporate treasurer.

Changes at Tripp Lite, Chicago:

Martin Pludé exits Newark Electronics, Chicago, as product manager and joins Tripp Lite as sales manager of industrial distribution. **Ward O'Connor** leaves B&K Precision, Chicago, as sales manager to become director of industrial distributor sales at Tripp Lite.

John K. Ramsey is appointed executive director of the Association of Public-Safety Communications Officials (APCO) International, South Daytona, FL, after **Christopher R. Bevevino** resigns from the position.

Awards at the Electronic Industries Alliance, Washington:

Richard A. McGinn, chairman of Lucent Technologies, Murray Hill, NJ, receives the 1999 Electronic Industries Alliance (EIA) Medal of Honor. **James S. Gilmore**, Virginia governor, receives the EIA's first State Technology Policy Award.

Ellen B. Mullally leaves Phillips Business Information, Potomac, MD, to join the Personal Communications Industry Association, Alexandria, VA, as director of communications.

Changes at Gabriel Electronics, Scarborough, ME:

Alfredo Vázquez exits Glenayre Western Multiplex, Sunnyvale, CA, as Northern Latin America sales manager to join Gabriel as regional sales manager. **Bud Bayer** leaves Digital Microwave, San Jose, CA, as western regional sales engineer to join Gabriel as western region sales manager.

Changes at Ritron, Carmel, IN:

F. Greg Pruett joins Ritron as national sales manager after working at Uniden Corporation of America, Fort Worth, TX, and Motorola, Schaumburg, IL, in various sales and marketing positions. **Jack Pelzman** joins Ritron as marketing communications manager after serving in similar capacities for Yaesu U.S.A., Cerritos, CA, and NEC America's mobile radio division, Herndon, VA.

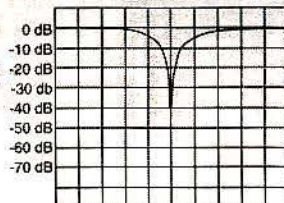
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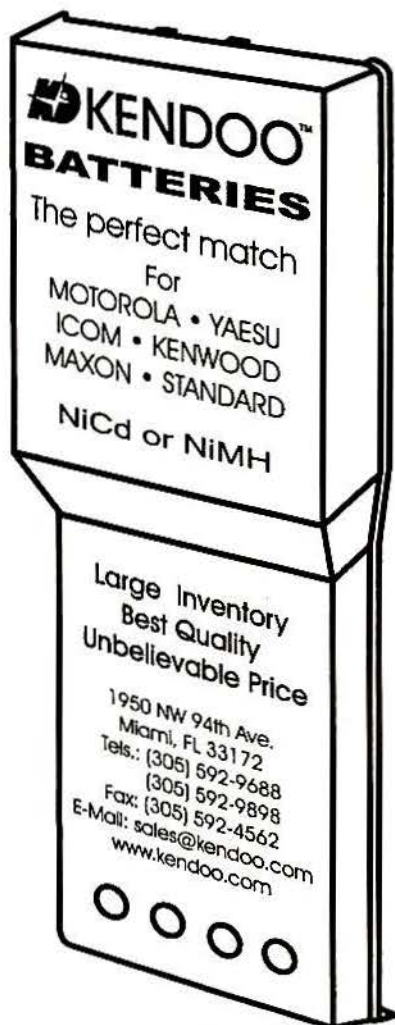
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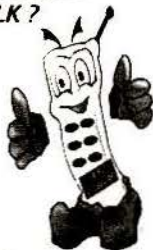
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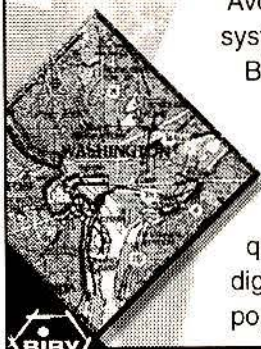
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	Racal 25	Competitor A	Competitor B	Competitor C		Racal 25	Competitor A	Competitor B	Competitor C
Volume (cu. in.)	19.1	23.9	29.9	40.1	Metal Case	Yes	No	No	No
Weight (ounces)	16	25	27	28	Submersible	2 Meters	No	No	No
Power (watts)	5	5	5	5	Keypad Programming	Yes	No	No	Yes
Channels	256	255	255	256	Battery Meter	Yes	No	No	No

**PROJECT
25
RADIO**

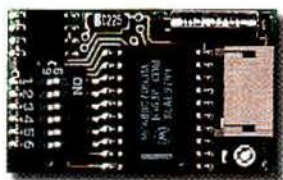
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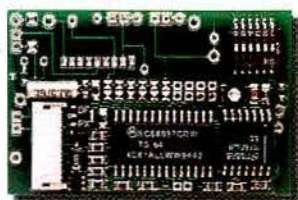
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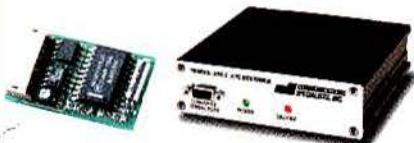
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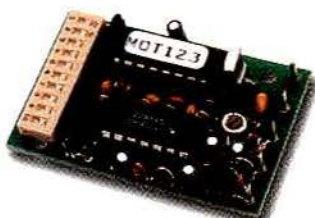
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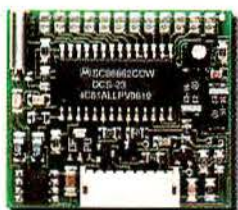
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